The American Quarterly of Roentgenology

Edited by P. M. Hickey, M. D.

Vol. III JULY, 1911 No. 2

TUBERCULOSIS OF THE LUNGS AS SEEN AND HEARD.

BY HENRY HULST, A. M., M. D.
Grand Rapids, Mich.

The paper is based on a collaboration. The forty-eight 14″ x 17″ plates on exhibition are from the Roentgen Laboratory of the Grand Rapids Tuberculosis Sanitarium which was opened by the Board of Health one year ago, and of which the essayist is director. To add to the interest of the work, the Board authorized securing the valuable services of Dr. J. B. Whinery, of Grand Rapids, a man of unquestioned superior ability as a diagnostician, for the special purpose of making physical examinations and records of his findings.

These are appended to the corresponding negatives with notes furnished by the city physician, Dr. R. Apted, of such autopsies as he was able to secure with the consent of relatives or friends. Descriptive reading of the plates themselves by the essayist, together with brief clinical excerpts collected by the assistant superintendent, Miss M. D. Shorneman, complete the legends.

The results were obtained independently, i. e., neither one knew the findings of the other. Dr. Whinery's notes and the

plate readings were finished before they were finally compared, and are given unaltered.

The purpose of the work was that of comparing one method of physical examination with another, not merely to establish the superiority of one of them, but to observe how they agree and differ and supplement each other in their results, and thus to determine the place each is best adapted to occupy in a **complete** diagnosis of Tuberculosis of the Lungs.

The exhibition is intended to speak for itself. The paper, therefore, does not aim at an exhaustive description and analysis of all the facts elicited, but is intended only to call attention to certain observations and conclusions which forced themselves upon us, and which we trust will be of interest to others.

A number of the plates show the trachea not only, but its bifurcation and bronchi traceable in some of them from hilus to apex and base. Such bronchi are distinguishable from the other branches starting always from the hilus and covering the entire lung fields. Bronchi make double contourred shadows, enclosing the lumen which appears as a half tone or dark streak, as it does in the trachea. Speaking of the trachea, it may be interesting to note that even it is not always recognized as such by people who write books. In a recent Atlas it is mistaken for the spinal canal. This raises the question of the significance of the so-called "bronchial tree," always the first thing seen on a good roentgenograph of a normal chest. Minor says he never sees it in normal chests. But Minor is a fluoroscopist.

I believe the negatives by themselves go a long way to prove that Hickey in 1904 was entirely correct when in St. Louis he advanced his opinion based upon experiment that "the tracings which we often see in the midst of the pulmonary tissue usually represent the ramifications of the pulmonary vessels." Emil Beck in the last number of the Fortschritte, also last number of our Quarterly, declares these shadows were a conundrum to him until the stereoscopic method revealed to him their true nature, which, he says, is bronchial. Schwartz, on the strength of four cases in which

he observed pulsation of the hilus, concluded, on the contrary, that the substratum of the hilus is vascular. "The hilus always pulsates, but this can be seen only in certain cases, particularly in such as present alteration of the lesser circulation." In this connection an observation by Köhler is significant. "In making up one's mind as to the true nature of suspicious looking hilus shadows, it must never be lost out of sight that the presence of a vitium cordis, favoring congestion of the lung vessels, may sometimes yield lung pictures resembling those in which there are caseating hilus glands." A year ago Fraenkel and Lorey made the observation on the atelectatic lungs of still born children that the roentgenogram did not show any trace of the usual ramification shadows. A partial inflation with air caused the trachea, bifurcation and bronchi to appear on the negatives, but as dark streaks and not as shadows. Upon further inflating the lung the bronchi disappeared, except the bifurcation, the columns of air no longer contracting sufficiently with their surroundings. But in their stead appeared another picture: hilus ramifications made up of shadows such as are seen in roentgenographs of living subjects. To bring out the bronchi, therefore, they should contain air, but the alveoli must be collapsed or nearly so. To bring out the blood vessels which contain blood even in the dead subject, the alveoli should be distended, the more the better. The former condition is a rare occurrence in the living subject. According to Fraenkel and Lorey, bronchi are seen only in atelectasis after closure of a main bronchus by a foreign body. When Beck wrote his article, he evidently had no knowledge of this work. If Hickey's experiments left any room for doubt, those of Fraenkel and Lorey, together with the evidence of these plates on exhibition, show that the normal "bronchial tree" is vascular. The plates, moreover, prove that the bronchi may be seen among, and distinguished from, the remaining vascular hilus branches, not merely in cases of atelectasis due to the presence of a foreign body in a main bronchus, but under the other abnormal conditions illustrated by the plates as well. Though in normal cases the bronchial tree, therefore, does not appear, in abnormal ones it

often does when the ramifications are due to both bronchi and vessels, and therefore I object to Fraenkel and Lorey's substitution of the term "vascular tree" for "bronchial tree" as "overshooting the mark," and propose to call it **hilus** when that only is meant and hilus ramifications when the other branches are in question.

In 1905 Rieder declared it as his opinion that tubercles cannot to be shown. In 1909 Krause, of Haidehaus bei Hannover, placed pieces of tuberculous tissue on the outside of a normal chest, and found in this manner that miliary tubercles do not appear on the roentgenogram. Further on he says miliary tubercles can be recognized. This discrepancy evidently is unnoticed by himself, but is easily explained by the fact that the miliary tubercles he did find were roentgenographed where they naturally belonged, i.e., in the lungs themselves. The mere removal of the miliary tissue by Krause, viewed in the light of Fraenkel's experiment on the vascular nature of the "bronchial tree," changed the tissue physically, enough (total or partial removal of air from alveoli) to spoil the experiment. But even if the tissue underwent no such alteration by its removal from the chest, it is not a matter of indifference whether they are roentgenographed in their original site in the lung within the chest or on the outside of it. For instance, very small pulmonary vessels show very well through the chest wall, while the intercostal vessels, though larger, remain invisible. The question, it seems to me, is practically not very important when we consider that a bacillary infection as such cannot be recognized by any physical examination. Even "in the case of typical tubercle the tissues present more or less inflammatory reaction in the form of congestion, exudation, cellular immigration and proliferation," as Hektsen observes. The fact remains that in miliary tuberculosis the lung-fields are evenly mottled. Partial disseminated haematogenous miliary tuberculosis frequently found in autopsies in cases of chronic pulmonary tuberculosis are plentifully shown on the negative as partial disseminated miliary mottlings. These, of course, cannot be recognized as such by sense of hearing. Again, numerous negatives exhib-

ited give a roentgenographic illustration of the following pathological description by Hektsen: "Radicals of peribronchial lymphatics being included in the tuberculous district, the bacilli easily find their way into the lymphatic vessels, and peribronchial lymphangitis results. Occasionally the process can be followed as peribronchial nodular cords clear to the lymph nodes at the hilus." As such mental picture can be constructed by means of the data furnished through the eight pair of nerves.

It will be seen that cavities, especially deep ones, were generally missed by physical diagnosis, though evident on the plates. Some of these show structural lung detail. This does not mean necessarily that the cavity is deep seated. Lung substance anterior to it or posterior or both may cause this appearance. Only large cavities or those with dense anterior or posterior walls are structureless. Their depth is best determined stereographically. According to Krause it is not true that a cavity filled with pus appears as a shadow. Cavities always look like cavities, contrary to what has always been thought, as dark spots, no matter whether full or empty, though they possibly may be hidden by extremely dense anterior and posterior walls. This is corroborated by our own autopsy findings on the bodies roentgenographed after death.

Speaking of the comparative symmetrical method of percussion, Dr. Waller, of Sweden, says: "If there be a dullness in the percussion sound heard at two symmetrical spots, and the difference in the degree of dullness is distinct, which often occurs, the dullness at the spot where the degree of dullness is greater may be miscalculated, i. e., underestimated, and the dullness at the other spot be neglected altogether." This is strikingly illustrated roentgenographically by some of our cases when symmetrical disease led to its recognition by sense of hearing on one side only. The other side was overlooked because of less fibrosis; i. e., because prognostically it was even worse than the other side, which was recognized.

A cursory examination of the Six Volumes of the Report

of the Sixth International Congress on Tuberculosis suffices to convince anyone that the question of the primary seat of infection is of extreme importance. And although only "complete post-mortem examinations in very many cases will show us the channel of infection" (Tendeloo), especially inasmuch as "tubercle bacilli may exist in apparently unchanged organs" as pointed out by Bartel and others, and Roentgenology cannot be expected to decide the burning question whether the alimentary tract is the more common port of entry or the respiratory route—the Roentgenographer nevertheless has a vital interest in it.

Thus physical diagnosis is pretty well agreed that the primary seat of tuberculous lesions in adults is at the apex of the upper lobe as originally taught by Laeunec, though it may be sought for variously, in the suprascapular fossa, as does Babcock following Kingston Fowler, or in the inner part of the supraclavicular fossa and the inner third of the infraclavicular region, as does Minor (the latter possibly not influenced by his fluoroscopic findings which show that "a shadow in the sterno-clavicular angle above the clavicle is very much commoner than a shadow behind.") Of this Tendeloo remarks: "It has been accepted for a long time that pulmonary tuberculosis begins in the apex of that organ. But this is an error that has caused much confusion. All explanations of the primary pulmonary tuberculosis, founded on this error, fall with it. Nevertheless, the seat of the primary pulmonary foci is of deciding value. I mean recovered, as well as not recovered, latent as well as manifest foci, which we find by post-mortem examination, by inspection, and last, not least, by exact palpitation of the lungs." (If so, the Roentgenogram ought to be of great aid even in this quest.) He continues: "By far the most foci are found in the paravertebral cranial part of the lung; that is, in a pulmonary sector close to the vertebral column, cranial from the fifth rib, about between the hilus and the apex, including the apex. . . "

As I pointed out years ago, and as most of us have noticed a long time Roentgenography looks to the hilus and its periphery, especially to the paravertebral cranial region described

by Tendeloo as the place where the disease manifests itself first radiographically. It is interesting to note in this connection that Krause, of the Sanitarium of Haidehaus, who has learned to make lung pictures by means of 2½ to 6 seconds' exposures (at the time of the Congress in Washington he still recommended 15-20 seconds)[1] now doubts the correctness of the older diagnostic view. "It seemed to us that the hilus was always enlarged when disease was present in the apex. The clinical method cannot discover such hilus changes, and this probably explains why the hitherto current opinion as to the primary seat of infection still prevails." Since this question is not to be determined by percussion, but as Tendeloo describes by autopsies, the Roentgen method may come nearer to the truth than physical examination by the sense of hearing.

"The diagnosis of tuberculosis of the lungs in infants by physical examination is impossible in a large proportion of children," says La Fetsa.

Mediastinal inaccessibility stands in the way of it. It is right here that the Roentgenographic method celebrates its easiest and most brilliant triumphs.

C. L. Minor, a phthisio-therapist, considers "the Roentgen Ray as of inferior accuracy to the physical examination." In saying this he but voices the opinion of the majority of his colleagues. The reason is not far to seek. Minor, for instance, asserts that "the radiograph gives such fullness of detail that it is difficult to distinguish at times . . . . between normal and pathological shadows. The picture given by the fluoroscope shows none of those misleading shadows, and thus is easier to interpret." He prefers the fluoroscopic image because it shows less! A picture taken by means of a long exposure, the patient breathing all the time, ought therefore to exactly meet his requirements! To be consistent he should stuff his ears when he auscultates. Other phthisiotherapists assign as their reason for preferring the fluoroscope the simple and more obvious one that it is much easier. It doubtless is. But also it must be insisted upon that it is their

[1] This is probably another Paul Krause, not from Haidehaus bei Hannover, but from Jena. The two should not be confounded as I did in the parentheses.

bounden duty to become expert in Roentgenography if they wish to do their whole duty. This some of them are doing. But many more not yet.

We conclude that distinction must be made between clinical and anatomical tuberculosis.

Thus a subject may be clinically, i. e., practically, well, yield no evidence on physical examination of the disease, yet react to tuberculin, and present post-mortem changes.

On the other hand, it is freely admitted that there may be auscultatory signs due to localized catarrh without lung changes and without clinical and roentgenographic evidence, the patient reacting or not to tuberculin. In the material presented, the roentgenograph never fails to show the disease in the presence of clinical evidence or physical signs. Moreover, the plate always showed more disease than was shown by the other method.

Hence a diagnosis should not be made upon the strength of a physical diagnosis alone, nor upon the tuberculin test alone, nor upon the Roentgenogram alone. The only one absolute test is the presence of the bacilli in the sputum. These being absent, a careful consideration of all these data in the light of clinical evidence should be insisted upon in making a diagnosis. The Roentgenogram, when as perfect as it can now be made as controlled by clinical evidence, constitutes the most valuable means at present at our disposal.

For prognosis symptoms are all important as compared with physical findings. This is less true of a Roentgenographic reading. In some of the series of plates the healing process is graphically shown—also the opposite. As Krause, of Haidehhaus, points out: "Physical methods fail us when we wish to construct a mental picture of the anatomical changes. In this respect the Roentgen method is a great improvement, inasmuch as it is able to furnish an idea of the anatomico-pathological changes." Or, translating Groedel freely: "The Roentgen method furnishes us new data with a new meaning."

The advantage of auscultation lies in the fact that Grancher's "respiration rude" can be heard before tubercles can be

seen. But this also constitutes its danger. It is easy to imagine and even when really heard by no means infallible.

The advantage of the tuberculin test lies in the fact that bacillary infection can be proved, though the negative shows no lung changes. But herein also lies its danger. "So far as adults are concerned, it is now generally conceded that it is possible to demonstrate tuberculosis, or traces of it, in most people, at any rate among the people of the larger towns." This condition is not necessarily a disease, as Flick points out.

The great advantage of the Roentgenographic method lies in the fact that it furnishes us with a picture, a correct (though incomplete) graphic reproduction of the microscopic anatomico-pathological changes themselves. These pictures must be read, however, in the terms of post-mortem findings and not of auscultation and percussion.

Every roentgenographer is not a roentgenologist, least of all a phthisio-therapist; but the latter must be an expert diagnostician in his own line of work, and in order to be that it is not enough to do fluoroscopy, but he must be an expert roentgenographer as well.

DISCUSSION

DR. LEWIS GREGORY COLE.

It is certainly most gratifying to me to hear this paper of Dr. Hulst's. In the past we have not always agreed as to what it was possible to show with radiograms of the lungs nor as to the interpretation of the radiographic findings, but with the exception of the one point to which Dr. Dunham referred, there is not a single sentence in this paper that I do not heartily indorse. In the radiograms of post-mortem specimens of the lung which I demonstrated at the Cincinnati meeting three years ago, one can differentiate the bronchi from the blood vessels by the hollow lumen of the former and can trace the bronchi from the bifurcation of the trachea almost to the periphery of the lung.

When Dr. Hulst began his paper I thought he was going to refer more definitely to the value of physical signs com-

pared with the radiographic findings and I was entertaining a hope that he would compare both of these with the post-mortem findings. I have been radiographing a series of such cases with the examining staff of the N. Y. Board of Health. They have their independent physical examinations made by different examiners and recorded. When they all agreed on the physical signs, the process usually was so extensive that it could not be considered incipient. One of the most interesting points of this series of cases was the variation in the location and extent of the lesions as determined by their independent physical examinations compared with the radiographic findings. Sometimes three different examiners would locate the process in three different parts of the lung. The radiograph would definitely locate the lesion.

DR. HULST (closing).

I was very much gratified with the discussion, and, like Dr. Cole, I believe that we do not differ as much as we think. We differ in emphasis and not so much in our opinions.

I never doubted the value of the X-ray in the examinations of lungs, or I should not have practiced it so persistently. Dr. Dunham says that the hilus ramifications are bronchial. Dr. Cole spoke of pathologic cases, and I said distinctly that the picture of the **normal** lung is made up not simply of bronchi, and therefore should not be called the bronchial tree. It is not made up of blood vessels alone, and therefore should not be called the vascular tree. In pathologic conditions it is made up of bronchi and vessels. Therefore, it should be called the hilus ramifications. I believe it is difficult to demonstrate the bronchi in a normal lung beyond the bifurcation. You may imagine that you can see them, but you cannot differentiate them. Of course, the picture is a record of density differences, but only up to a certain limit, and also the differences must be considerable before the plate will record them. If we could get a record of all density differences on the plate, we would be doing wonders. However, we are doing much better now than we did formerly in the way of recording the slight density difference of soft tissues.

Dr. Cole spoke of comparing the various physical methods of examination. Physical diagnosis is a difficult matter. It is much easier to read a radiogram than to differentiate a respiratory murmur, especially the "respiration rude" of Grancher. Babcock, whose hearing is most acute, says in his book that if two diagnosticians go over the same lung, they are likely to give different readings.

Another point: The bronchi are tubes and you know what they do,—conduct sound, and one must not suppose that the disease is necessarily at the place where the sound is best heard. I think that the way to make the roentgen method of examination find a place in the diagnosis of lung tuberculosis is not by showing how much better we can do it by means of Roentgenography than by the older methods, but by showing how much more complete we can make it. The men who work with me have been converted to this method, and they appreciate it.

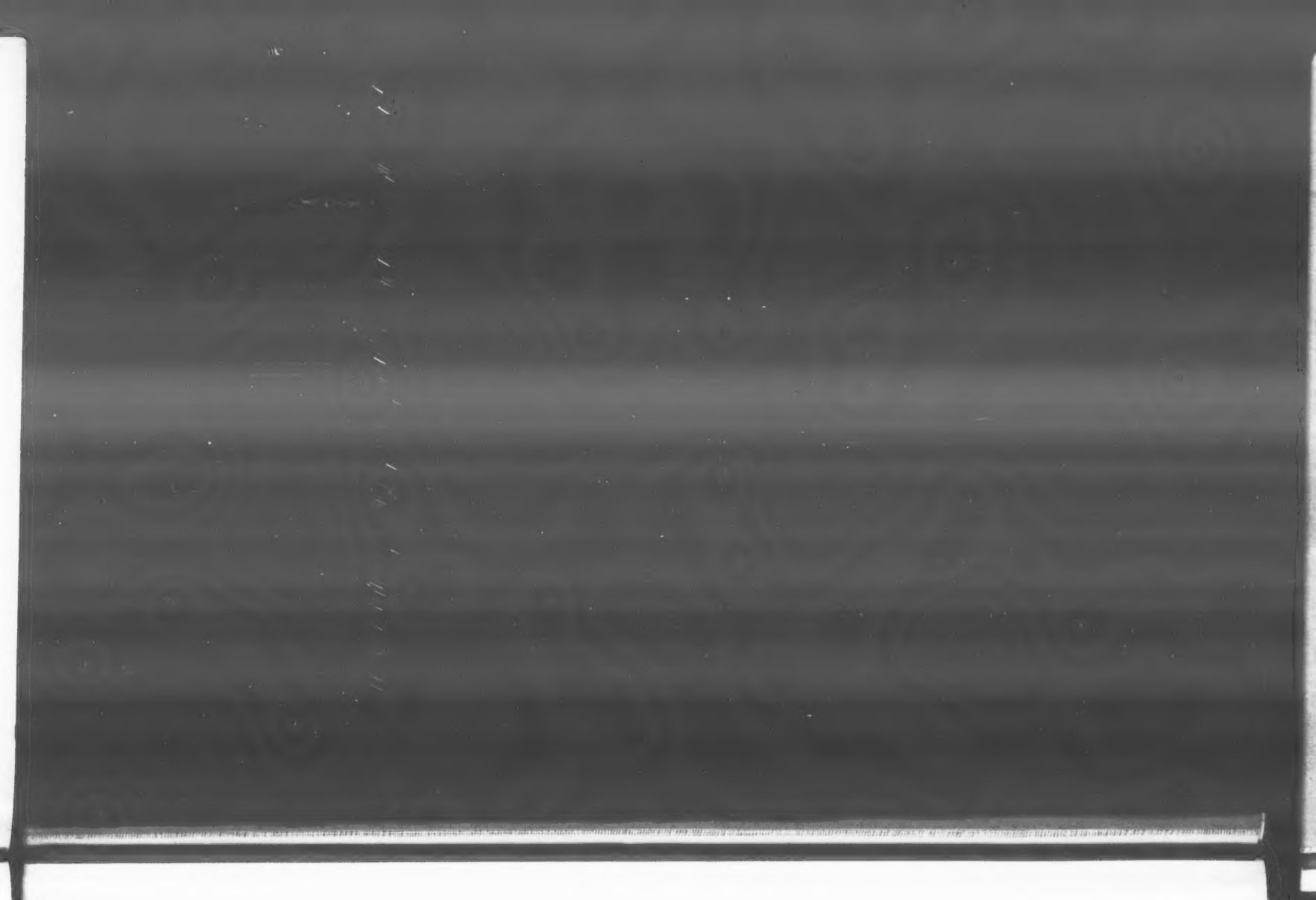
THE TECHNIQUE AND READING OF STEREO-CHEST PLATES WITH ESPECIAL REFERENCE TO TUBERCULOSIS.

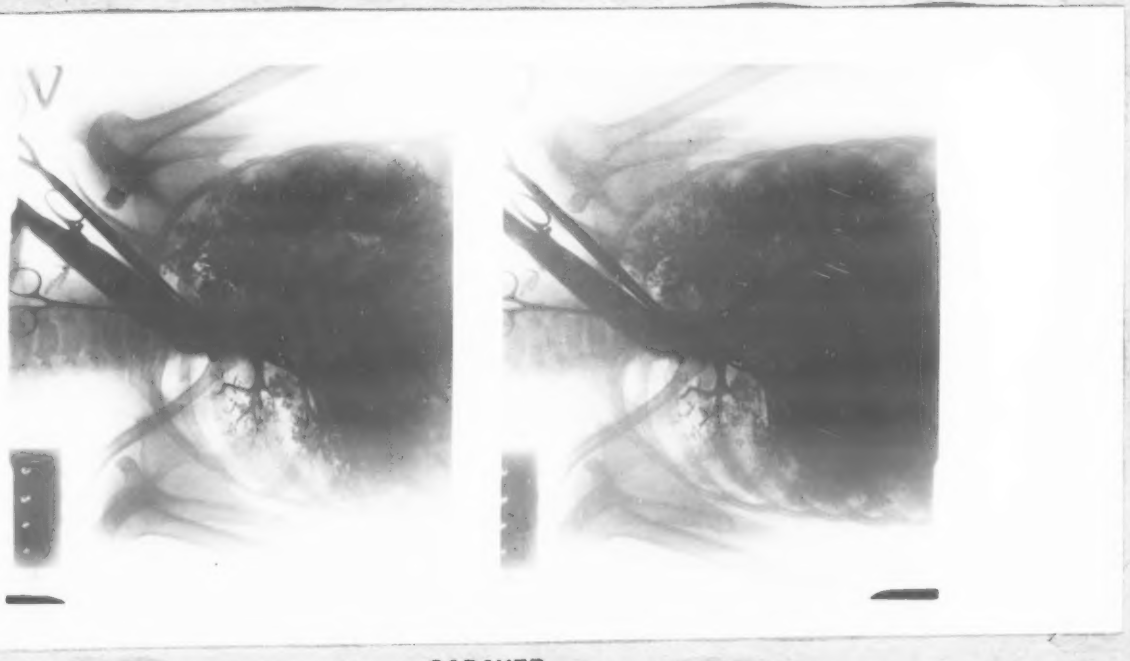
BY DR. KENNON DUNHAM, CINCINNATI.

From the very beginning of the use of the Roentgen ray in diagnosis, no part of the human anatomy suggested such possibilities as did the chest. Here the great differences of density were very alluring, but the necessary short exposures, so that the breathing and the pulsations of the heart would not disturb the **finer markings,** were very difficult to procure. Dr. Hulst presented to this Society the first one-second exposure which I had ever seen. The richness of detail was wonderful. Those of us who were compelled to expose from five to ten seconds were forced to the use of the fluoroscope for much of our lung diagnosis. Subsequently it became evident that even technically perfect plates, as Reeder calls them, would not do. The markings must be filtered out, as many densities of most important tissues lay one upon top of the other and could only be seen as one shadow. Stereoscopic plates suggested themselves. Here the technical difficulties were more than doubled. Many men showed such plates but either the markings were lost by long exposure, or too much time was allowed to elapse between the two exposures and the plates were imperfect. Certainly there were exceptions. Hickey showed us some at our last meeting.

To secure good stereo-plates, the exposure of each plate should not be longer than one-tenth second, and the time from the beginning of the first to the end of the second exposure should not be over one-half second, and this time must not be gained at the expense of the plates.

Such perfection has not been obtained in my work, but last winter a technique was developed which enabled me to secure two good radiograms and move my plates and tubes while the patient easily held his breath. On an average the





CADAVER

Bismuth injection into trachea and bronchi. Tubing passed thro descending vena cava into heart. Left side, upper and lower lobes clearly defined, showing upper and lower divisions. Injection extends to periphery. On right side, bismuth has not passed to periphery of upper and middle lobes; lower lobe is fully injected.

Upper right lobe shows—trunk (I) passing parallel to the spine toward the apex above the clavicle. Trunk (II) passing from bronchus upward, backward and outward toward fourth rib in back. This is bronchus seen behind first interspace. Trunk (III) passing laterally and forward, giving off branches, one of which is seen behind first interspace. Branchings of the other trunk are seen behind second interspace. Trunk (III) and branches are usually seen lower than in this specimen. Trunk (IV) is usually not made out during life. Middle right lobe—Trunks come off from bronchus much below those of upper lobe, one passes forward and the other backward.

THE
JOHN CREAR
LIBRARY

chest of a large man could be taken in two seconds for each plate, and plate and tube moved in two seconds, thus allowing six seconds for the operation. This was not good enough, but it would do, and this series of exposures was undertaken to ascertain the value and limitations of the stereo-roentgenogram in tuberculosis of the chest.

The work now finished will be presented in three papers:

I.—Technique and Reading (This article).

II.—Lung Markings as Due to Arteries, Veins, Bronchi and Connective Tissue (Dunham and Boardman).

III.—Correlation of Physical Examinations, Tests and Radiograms (Dunham, Wallman and Boardman).

Also the work has suggested that possibly in tuberculosis, there occur changes in the supporting connective tissue around the blood vessels and bronchi and even between the lobules beyond what is usually described by pathologists, and that these changes, with the diseased blood vessels and bronchi, might account for the changed markings noted in such plates. Therefore the work will be continued.

Lobes of normal and early tubercular lungs will be rayed stereoscopically and then large sections will be cut at different levels of the lobe so that any changes may be followed and described.

This first paper must refer to the second and third, but will deal with the technique and reading of stereo-chest-plates.

The advantages of the stereo-plates over the single radiogram have been well stated by Winkelbach (A. of R. R., Dec., 1908, No. 101). The physical and optical principles underlying the stereo-roentgenogram have been most graphically set forth by Eichman (F. a y d der be R. Juli 1909). This latter article has been a great help as it showed conclusively that the variable base of Marie and Rebou was not only troublesome and unnecessary but incorrect.

Two fundamental principles underlie the procedure of conveying the three dimensions of an object to the mind by means of two X-ray plates; these principles are linear and aerial perspective.

That part of linear perspective which is useful to us is utilized when two images are taken at different angles so as to simulate the different angles used by the right and left eyes. For reconstruction these images must be placed in such a position that we can only see the one image with the right eye and the other image with the left eye. In this manner if our eyes are as far from the image as the tube was from the plate, and if the plates are in the correct position, and further if the tube has been moved the exact distance our right pupil is from our left, then we will have the right image superimposed upon the left so that we recognize only one image but that will have the three dimensions and we will see the front separated from the back. From two chest plates thus taken, if the technique has been perfect and the patient has not moved, a mathematical reconstruction can be made which will give as exact an idea of the position of the different densities of that chest as if our eyes could see by the X-rays as they can by the sun's rays.

It is necessary, however, not to forget that the aerial perspective is due to the fact that distant objects appear more hazy and less distinct than those nearer to us. The window sill from which one sees, appears much plainer (whites and blacks more pronounced) than that of the house across the street. Thus if we take a ventro-dorsal stereoscopic picture of the chest there is a great tendency for the back to force itself upon us and make it appear as a back view. This is especially true if the tube has moved farther than the pupilary distance of our eyes, or if the muscles of our eyes are tired. This is largely a psychological effect produced by the fact that we are accustomed to see the nearer object more distinctly. That is, we are accustomed to use aerial as well as linear perspective.

As has been suggested, many difficulties have had to be overcome, but today it is as easy to take two good, not perfect, stereo-chest plates, as it was a year ago to take one flat plate. Our tubes, generators, tables and plate-changers are all better and stronger and are more perfectly adapted to

LUNG SEEN IN NO. 1 REMOVED FROM CHEST

Rubber tube containing shot seen on right side. In upper right lobe some blood vessels also injected. The five divisions, three on right and two on left, should be easily made out.

THE
JOHN CRERAR
LIBRARY

their work. As has been seen one plate must be exposed, the tube moved, Plate 1 must be replaced by Plate 2, and the second plate exposed. This must be done quickly, the patient must not move, his diaphragm must not jerk and his heart must not beat a sufficient number of times during either exposure to blur the lung markings.

This is accomplished, after the first exposure, by having a tube carrier that will move just the necessary distance and no more by pulling one string while another string pulls Plate 1 out and Plate 2 in, without disturbing the patient. This accomplished, the second exposure is made.

The plates are then developed, dried, placed in a large-sized Whetstone stereoscope and read.

The distance the tube is moved—"B"—is called the base-line, and this should be parallel to the plate. A perpendicular from the focal point of the tube to the plate is called the principal ray—"R." Where this principal ray penetrates the plate is called the foot-point—"F." The steel rods perpendicular to the plate, which I have attached to the table above the plate, one on either side of the patient, for the purpose of finding the foot-points, I call the foot-point finders.

The base line is the most important part of the stereoscopic exposures. It should be six c. m. long and must be at least twenty-five c. m. from the top of the object exposed. It must be parallel to the plates, or the exact deviation must be reckoned and accounted for in the stereoscope.

Eichman gives the length of the base line as 6.5 c. m., while Snook, at the last meeting of the A. R. R. S., placed it at two and five-eighths inches. Both use as their standard the pupilary distance and this is correct. I have made my base line 6 c. m. because more people have a pupilary distance under than over 6.5 c. m., and the foreshortening of the perspective is so slight as to be negligible. Thus more people are able to see the plates stereoscopically and also the plates are more readily reversible. This is no great help, yet in border line cases it sometimes accentuates markings which might otherwise be overlooked.

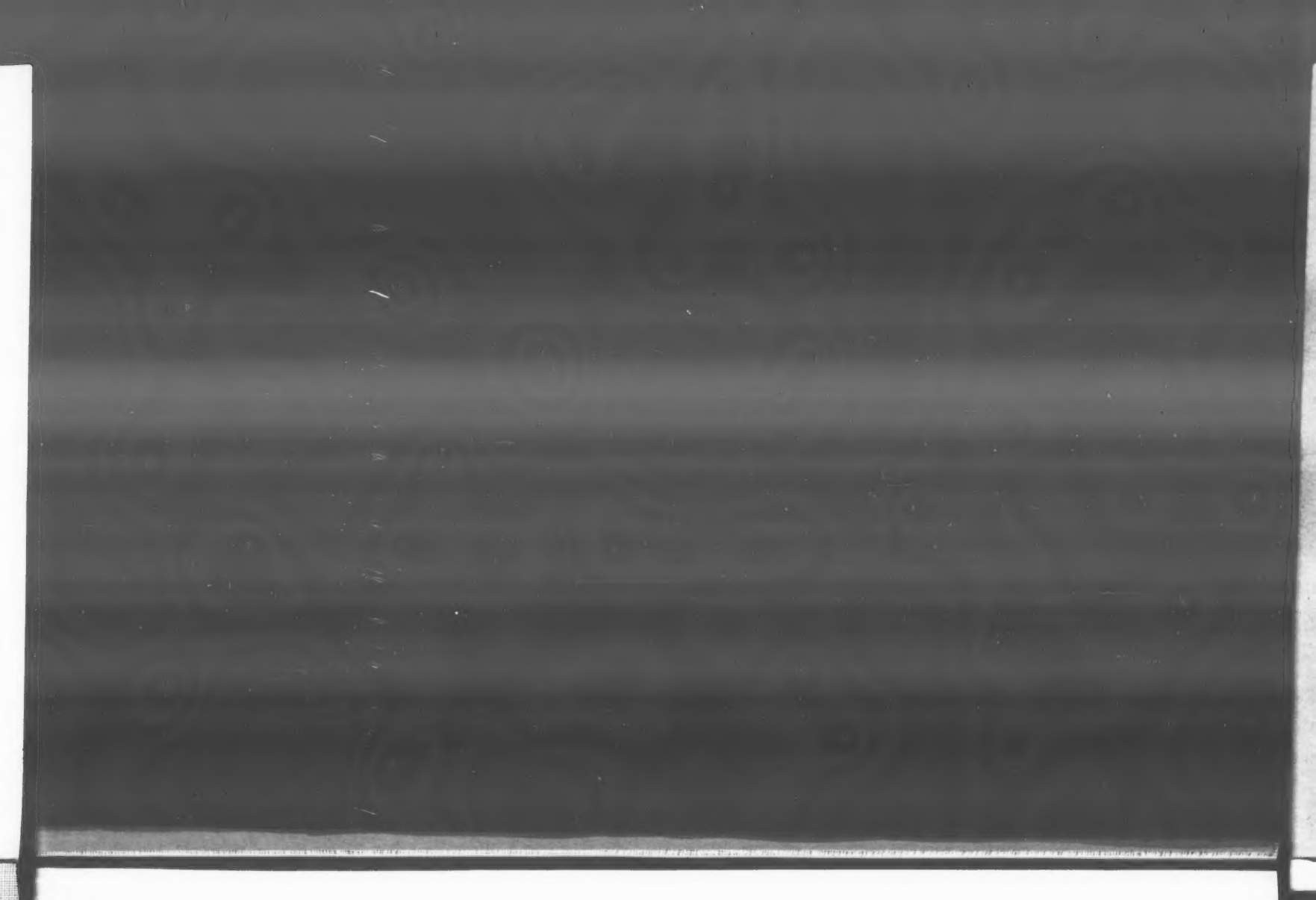
The base line must be at least 25 c. m. from the nearest part exposed, because stereoscopic vision is not possible much under it. That the base line should lie parallel to the plate and that Plate 2 should, during exposure, be in exactly the same position as that occupied by Plate 1 during exposure, is evident. The only exception to this necessity is when changes are accurately recorded and the stereoscope adjusted for them.

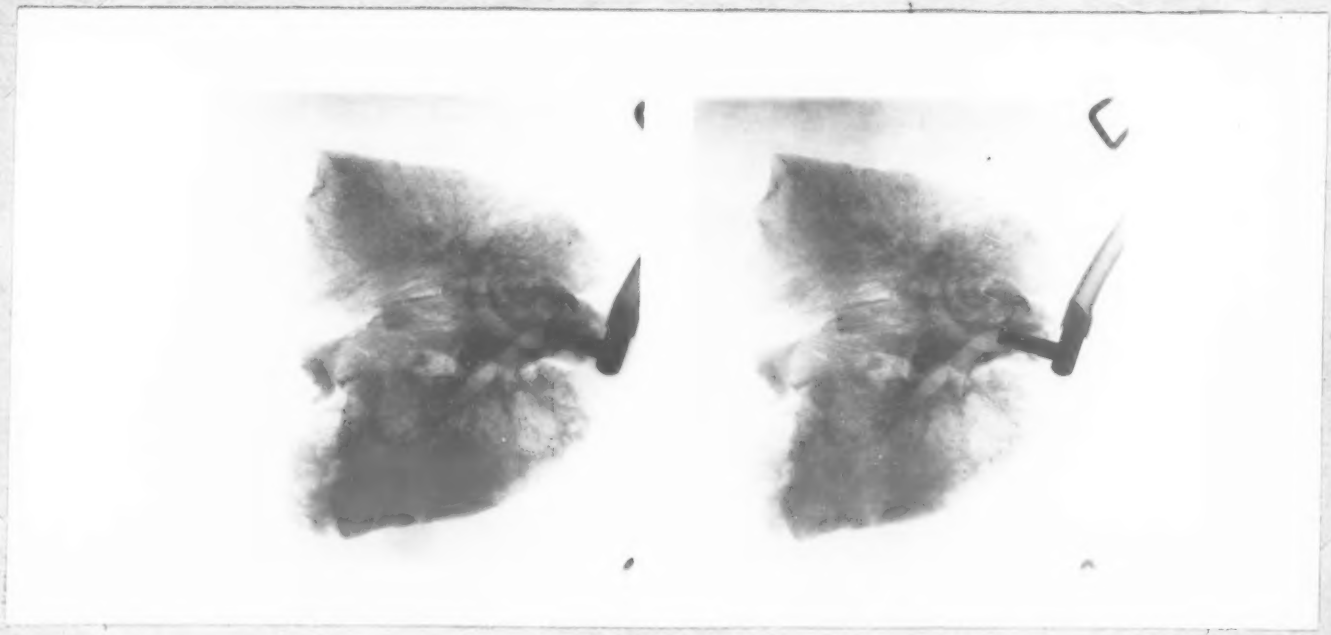
It is true, as has been said to me, that all sorts of liberties can be taken with the above fundamental stereoscopic rules, and still good relief be secured. Nevertheless, any deviation necessitates a disturbance of the image points and a **mathematical** reconstruction is impossible. A picture is obtained, it is distorted though it appears to be excellent and not having the object with which to compare it, you are fooled into believing that it is correct.

It is necessary to know the location of the foot-points if we desire to make a comparative study of the plates or wish to reduce stereoscopic plates so that they can be used in the hand stereoscope or desire to reproduce plates for publication. Also if we wish to make our exposures one like the other, it is necessary to ascertain closely the principal ray before exposure.

The latter is easily found by having a pointer that can project from the center of the diaphragm before exposure and easily be removed. The former I have accomplished by having two perpendicular steel rods (previously described) pointing up from the top of the table on either side of the patient's neck. The shadow falling from these uprights, as long as they are in a plane with the principal ray, can be extended along the plate toward the tube until they cross. The principal ray must reach the plate at this point. This is the foot-point. The relation of patient, tube, base line and plates is very important.

I maintain, although this series has been taken with the patient lying chest to plate, that the upright position is the best for thorax exposure, because it is easy to assume, the





INFLATED LUNG REMOVED FROM CHEST

Large caseous and calcified gland lying close to right bronchus; also small area of calcification seen in lower part of middle right lobe. The five divisions, two on left and three on right, should be easily made out.

heart disturbs the markings of the left lower division to a much less extent and it is easier for the patient to hold his breath. The **plate** should be to **chest** (dorso-ventral). This gives greater space between the ribs and allows the scapulae to be removed to the side of the chest by simply drawing the shoulders forward and further facilitates perspective because the ribs at the back are heavier than at front and cast a denser shadow. As we observe pictures exactly as we expose them, we see the ribs near the spine brighter and closer to the eye. Then the effect of aerial perspective adds to our reconstructed image, because, as has been said, that is the manner in which we are accustomed to observe objects.

The base line should cross the ribs, not the spine. This will necessitate viewing the patient as though lying on his side, but that is no detriment and it will allow us to see around the ribs while with the base line across the spine we would have to see around the spine. The latter position is useful when viewing mediastinal conditions, but the former when studying pulmonary conditions. I prefer to have my first exposure through the 7th D. V. and my second through the 4th D. V. or vice versa, but this is not material as long as the principal ray passes near the spinal canal and we know at which D. V. the principal ray has passed. Further the plate must be large enough to extend from above the apices to below the diaphragm. Usually a 14 x 17 inch plate accomplishes this if placed with its long dimension across the chest. A smaller plate will not serve so well.

The tube, generator and method of development are an all-important part of the technique, but I hesitate to speak of them because so many men get such excellent results in so many different ways.

It is necessary to have a generator with a sufficiently large output and a tube which will take it so as to get a good picture in at least two seconds without the aid of a screen. Even the best of the new Wolfram screens will not show the fine radiating markings with sufficient detail for this work. To secure perfect plates of the lower left base less than one-

fifth second is necessary. I have one plate taken in one-fifth second on which the linear markings of the lower left are disturbed. I have repeatedly shown that not only the markings of the left lower, but of the right lower as well, are decidedly disturbed by a three-second exposure. The right base is usually clear with a two-second exposure.

My developing formulae are as follows:

A	Sodii Sulphite (dry)	250-500 grms.
	Sodii Phosphate (C. P.)	120 grms.
	Hydrochinane	70 grms.
	Edinal	50 grms.
	Water	3500 c. c.
B	Potasa Carb (dry)	500 grms.
	Sodii Phosphate (C. P.)	150 grms.
	Water	3500 c. c.

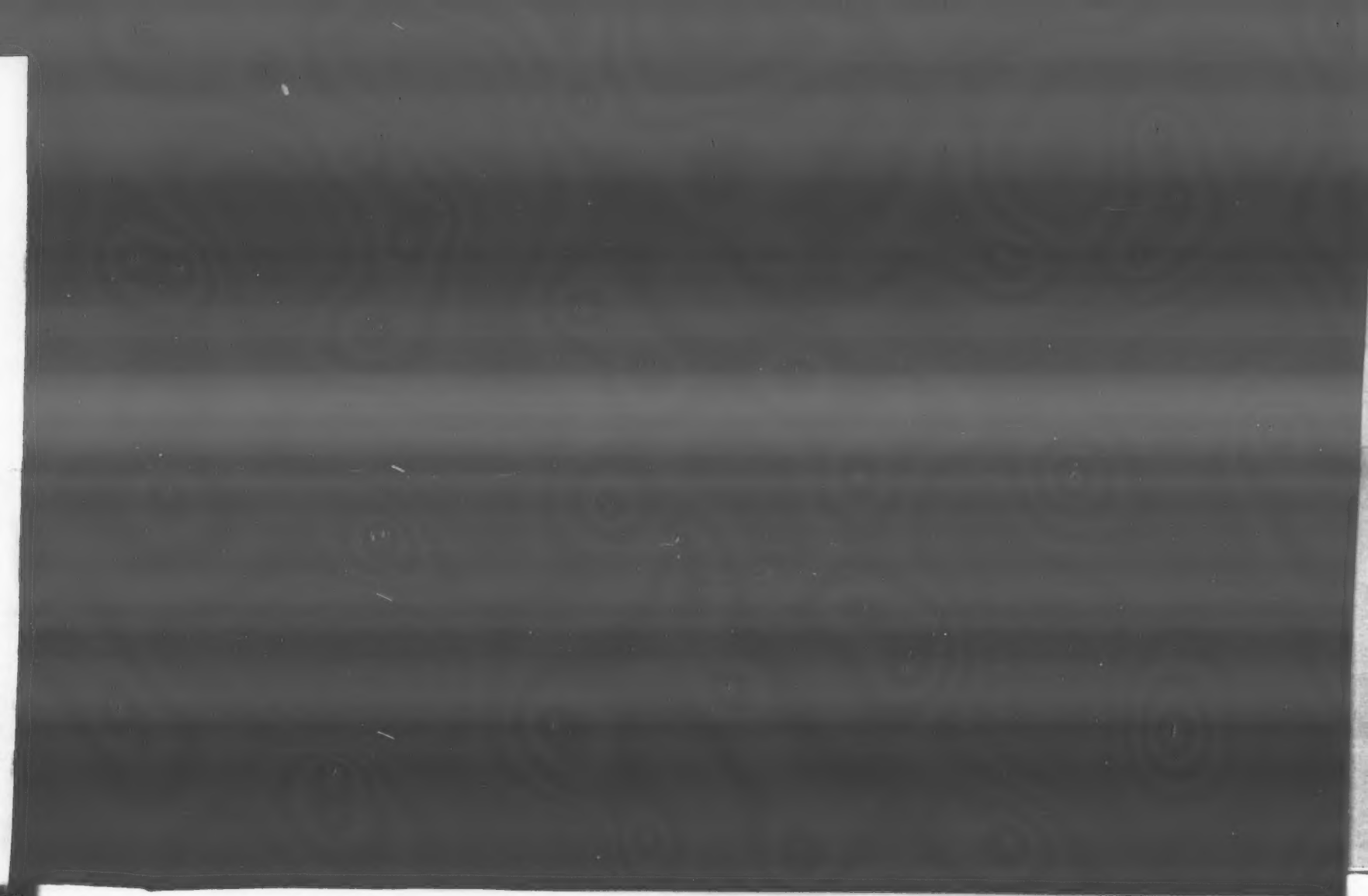
To use mix equal parts of "A" and "B" and use after first developing an unimportant plate before you try a good one. Add a small amount of developer after each two plates and filter frequently. Develop at a temperature between 65° and 70° F. There is no objection to bromide if you find it necessary.

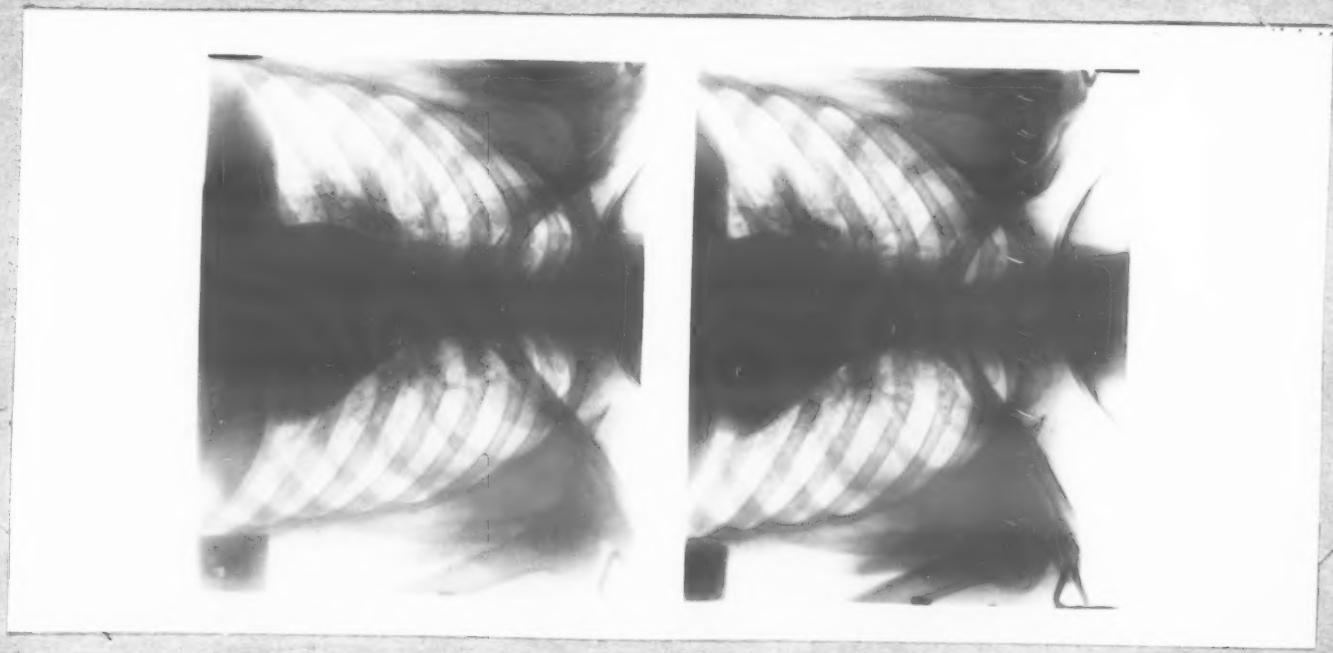
This technique can be improved without changing tube, generator or table by a time switch, a penitiometer, constantly attached to tube and by tank development. This will remove three unknowns and give us three constants in their place which we can adjust until found satisfactory.

Having shown how stereo-radiograms may be taken it now becomes necessary to see them in relief.

The most practical method of reconstruction of which I know is the Whetstone stereoscope. It has some slight inaccuracies as shown by Eykman, but it works, though the triple reflection from the mirror is often very annoying.

The Whetstone stereoscope as now used consists of two mirrors at right angles to each other and set at an angle of forty-five degrees with the face of the illuminating boxes.





CADAVER

Hilus and trunk shadows abnormally heavy. Linear markings normal. Heavy density seen to right of spine between fifth and first ribs. Postmortem showed this to be caseous and calcified glands, also tubercular mediastinitus with parenchyma comparatively free.

THE
JOHN CREAR
LIBRARY

By this means Plate 1 is seen by one eye, let us say the right, and not seen by the left, while Plate 2 is seen by the left and not by the right. To the mind this conveys the impression that only one image is seen, but that image appears as in relief.

By this method we have taken and examined in the Phipps Dispensary of the Johns Hopkins Hospital more than three hundred stereoscopic exposures and for practical purposes these have been very satisfactory. Much of the work has been purely experimental and, as has been said, will be reported later. Some cases which have been taken have been removed from the series, because the plates did not show sufficient detail and a second exposure was not obtained or the clinical history was lost. So our series only includes something over a hundred and sixty living and eleven autopsy cases.

Many of the living cases were clinically normal and the remainder were suffering with various diseases. The correlation of the physical signs, tuberculin tests, sputum examinations and X-ray readings in these cases showed that the clinician agreed with the X-ray findings very closely.

In explanation it must be noted that these were very exceptional physical examinations and every other known laboratory test was at the service of the clinician. Further, that Dr. Wallman, who had charge of the physical examinations, is one of the keenest pulmonary diagnosticians with whom it has been my good fortune to come in contact. Further that the X-ray readings in this series were made, as they should never be in practice, without a knowledge of the clinical condition of the patient. Also, many plates were reread without knowing whose plate was taken, and the results in every case corresponded with the previous readings.

Whether the plates agreed or disagreed did not depend upon whether the case had or had not had tuberculosis merely, but upon which lobe or division of the lung was the one involved and often upon many minor points.

It is further to be remembered that this work was done

by a very new empirical classification which time must necessarily show incomplete and imperfect.

Therefore with this showing it seems only fair to draw the conclusion that although this is an empirical reading, it has somewhere a foundation in fact. These cases will be fully dealt with in our third paper.

These readings are absolutely dependent upon the stereoroentgenogram and cannot be made from a single plate. Therefore stereoscopy is a necessity. It will probably be found that tetraphony and polyphony (the taking of three or even four exposures instead of two as recommended by Eykman, A. R. R. June, 1909, No. 107) will be a great help, as it will give us exposures across the spine as well as across the ribs. But as Kipling says, "that is another story."

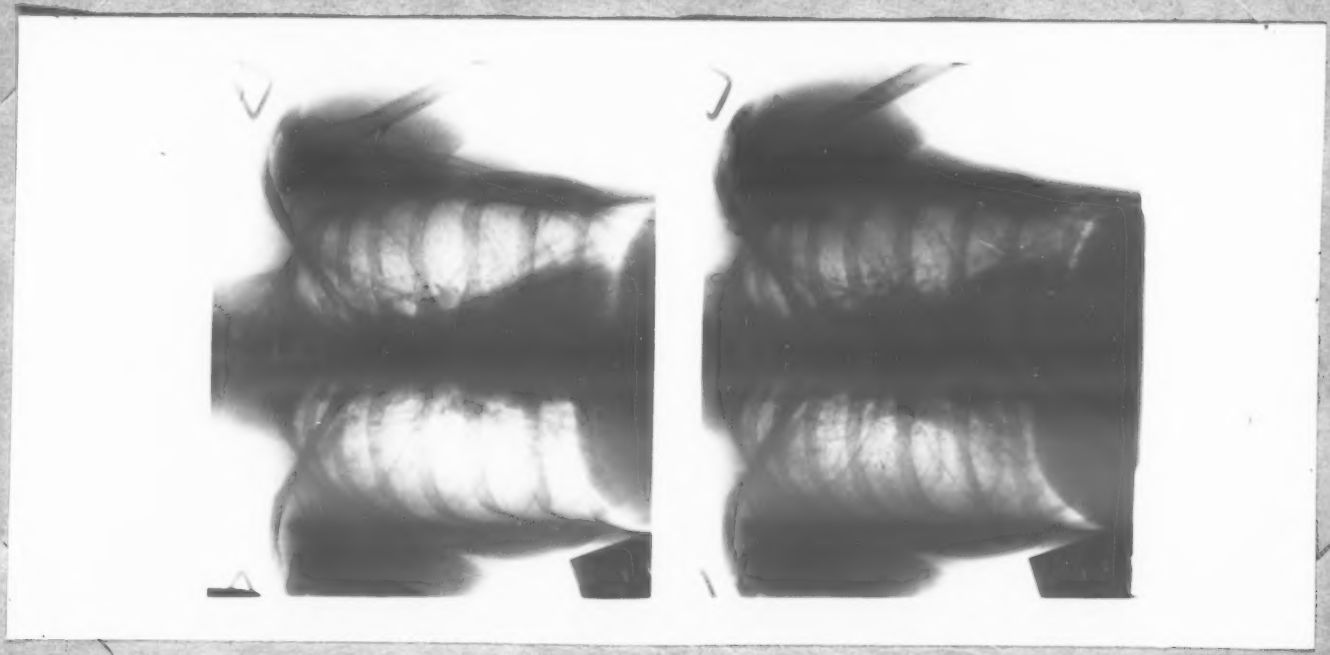
Before describing the markings characteristic of tuberculosis, let us consider what can be seen and then decide whether it is normal or pathological.

The bones should be noted with especial reference to the spine and the relation of the ribs to it; the cartilages, as to whether they are calcified or not; the muscles, pectoral, diaphragm and the heart with its vessels. The aorta is usually made out clearly.

This brings us to the lungs with their heavy hylus shadows, into which can be traced the trachea and from which pass the trunks. Beyond these trunks we see the fine linear markings. It is in these we find the most constant and characteristic T. B. changes. Much has been written as to the tissues which produce these densities but it is often difficult to say to which part of the plate the author refers. Therefore we will divide the pictures.

We will not here discuss heart and aorta, but first notice right and left thorax.

In the right thorax, just to the right of heart and often contiguous with it, is seen a large, heavy mass of increased density, which differs in almost every adult plate. This is the hylus shadow. From the hylus can be traced heavy trunks of increased density and these go to the three main



TUBERCULAR CHEST DURING LIFE

Hilus and trunk shadows abnormally heavy, with general breaking up of linear markings throughout the chest. This is especially marked in upper lobes, more on right than on left.

THE
JOHN CRERAR
LIBRARY

divisions which correspond roughly to the lobes of the lung. In bismuth injections of the bronchi these correspond very accurately to the lobes, and in some cases of disease these divisions are almost as clearly marked as in the injected cases.

Thus on the right side we have the hylus, the heavy trunks and three main divisions, an upper, middle and lower.

On the left we have again the hylus, but it is much less in evidence, being largely covered by the left heart and aorta. Again we have the heavy trunks but they run off in two main divisions which correspond roughly to the lobes, and can be clearly made out in the injected cases. In only one clinical case have I found the lingual tip of the lower left lobe made out. Thus on the left side we have the hylus (small), the heavy trunks and two main divisions.

Further the trunk going to either upper lobe has three branches. The first passes up from the hylus parallel to the spine toward the apex. The second passes out from the hylus up and backward. This branch is seen to lie behind the first interspace of the chest. The third branch from the hylus passes anteriorally and laterally toward the periphery and is seen behind the second interspace of the chest.

In many of these stereo-plates the trachea is clearly seen; it divides generally into the right and left bronchi in front of the fifth D. V. Frequently the bronchi can be traced either to the right or left, sometimes to both and is often seen to branch and pass to their separate divisions, as the bronchial branches pass to the lobes.

Beyond the heavy trunks, we have in health fine linear markings, which when viewed stereoscopically, radiate, break up into fine fibrils and on my plates do not reach the periphery. This radiation cannot be differentiated from interweaving on the single plate, but can stereoscopically.

In studying the plates of cases of tuberculosis, one notices four important changes from the normal. First, the large brilliant areas of increased density, which are probably due to lesions in the glands. They are only of importance when

accompanied by increased density of the hylus shadow and heavy trunks. Then they suggest mediastinitis, probably of tubercular origin.

The second important thing is to note the thickened trunks with the changes in linear markings. These latter changes consist of increase of density and breadth; frequently their course is studded, sometimes almost to obliteration of the lines. Normally these lines radiate in all directions from the heavy trunks, and can be traced in the lung removed from the chest, to the periphery. With the normal lung in situ, I cannot trace them to the periphery with my present technique.

In tuberculous cases these radiations are lost and replaced by an interweaving, sometimes of fine, sometimes of coarse mesh, and the radiations are so much increased in density, that they are easily seen extending to the periphery. In more advanced conditions, cavity formations may occur. Rieder sometimes finds these quite early, but such has not been my experience. On the other hand, the area may be so infiltrated, that the interweaving is blotted out by means of increased density, even to the consolidation of entire lobes.

Any study of pulmonary tuberculosis must lead to a study of pleurisy, and pleurisy with effusion. The third noted change concerns pleurisy. The post mortem examinations have shown that marked pleural adhesion may easily exist without detection, and the clinical cases have shown, that one-sided muscular development may easily increase the density of that side, so as to suggest a pleurisy. Yet irregular folds of pleura may be detected at the apices, and sometimes at the diaphragm, while inter-lobular pleurisies of moderate magnitude are easily seen. But the evenly distributed pleurisy which spreads uniformly over one or both chest walls will frequently defy detection.

The fourth change is when there is pleurisy with effusion. Liquid in the chest, whether purient or not, whether associated with simple effusion or pneumo-thorax, or as a saculated inter-lobular effusion, is easily detected. In hydro-pneumo-thorax, with the patient in an upright position, the liquid remains horizontal and the lung appears collapsed. In

effusion the surface of the liquid is not level, whether the patient is upright or prone. In the cadaver, where the internal pressure of the lung is relieved, the liquid naturally seeks the most dependent position of the chest.

Pleurisy with effusion presents in these stereoscopic plates a most interesting appearance. The liquid is confined in the limited area of the chest, and is pressed upon by the internal pressure of the lungs, which has a tendency to drive it up at the periphery and to hollow it out towards the base. The pressure of the lung is evidently not uniform, but is apparently held in place by trabeculae, between which the lung presses with more force upon the liquid. Thus we have upon the plate the appearance of the liquid being scooped out, which verifies the simile of Emmerson, between pleurisy and a partly filled, tightly corked bottle of water in a hot-water bag, pressed upon by the rubber bag which could be inflated. But were that rubber bag covered with a balloon net, the simile would be more complete.

This sums up the four recorded changes upon which I would base the diagnosis of tuberculosis. Here as in nature nothing is truly diagrammatic. The seeing is not so easy as it may seem; one is often in doubt. There are many border line cases. Nevertheless in a series of 92 cases (the ones examined by Wolman) we concurred absolutely, even to the location of the lesion, in 85. This included 14 non-tuberculous. Six of seven showed a disagreement as to extent, and in only one case was there an absolute disagreement. Thus it would seem that there was a good reason to believe that with the proper study of a large number of cases, some such classification would be found to be a great help in differentiating tuberculosis from other forms of pulmonary trouble.

It must be remembered that certain heart conditions such as mitral insufficiency with loss of compensation, may change the markings, and that pneumosiderosis might give a plate which would simulate even the stereo-picture of tuberculosis.

In this series no attempt has been made to read the lower left lobe. In almost all cases the linear markings have been

disturbed by the heart and the finer branchings cannot be made out. When these markings are seen in the lower left, it is probable that we have peri-cardial adhesions.

Before concluding I wish to say that apex plates are also a necessity, but that they must be taken stereoscopically and that we have developed a special technique for this purpose. Birsch-Hirschfeld, Albers-Schonberg and Hickey have shown this necessity. It is very important to secure the correct angles. Here it is possible to use to advantage a softer tube and a longer exposure. But all this too "is another story."

This paper does not deal with the fluoroscope. These readings have been made without its use, but it would be a step backward to discard its aid.

The greatest danger to our diagnosis from the single plate lies in the fact that we are tempted to read too much. This is true to a less extent in the stereo-roentgenogram. The normal cases taken have been fully as instructive as the tuberculous.

We have found that it is the exception rather than the rule to be able to differentiate between active and passive lesions. So far as I know there is no royal road to this. A very careful history and physical examination, and close observation over a sufficient time are the deciding factors. If a lesion can be seen by this means to advance from time to time, it would be of great value. A calumet eye reaction—one or five per cent—seems to have some value.

In concluding I would say that by means of stereoscopic chest exposures a very accurate anatomical condition of the chest is suggested. We have certain changes which occur in tuberculosis, which are quite constant, but in what other diseases they might also occur we do not know. It seems possible, as I said, that such changes might occur in mitral lesions, with broken compensation, and in pneumosiderosis (we have not observed a sufficient number of plates to know whether these findings are constant in mitral lesions and in pneumosiderosis or whether they could be differentiated from each other or from tuberculosis). A great number of

observations by many observers can alone settle these points. It must be remembered that the linear markings are blotted out by large areas of increased density in advanced cases. And further that the stereoscopic plates must be taken with geometric accuracy, with close attention to many technical details, since only "technically perfect plates" are of value.

In a subsequent paper we propose to show that these markings are produced by arteries, veins, bronchi, and probably by their supporting connective tissue, and possibly by the lymphatics. This does not mean that we expect to show each separately; we do not. It is evident that the change in markings in tuberculosis is due to changes in the vessels, bronchi, connective tissue or lymphatics and further research will be instigated at once to determine which is most changed and to what extent.

CHRONIC JOINT DISEASE FROM A ROENTGENOLOGIC STANDPOINT.

BY ROLAND HAMMOND, M. D.
Providence, R. I.

The Röntgen rays have been of the greatest service to the orthopedic surgeon in enabling him to classify and diagnose, as had never before been possible, those obscure arthritides which had previously masqueraded under the loosely fitting garb of "rheumatism." Early in the development of Röntgenology, those workers who were especially interested in joint diseases began the study of plates illustrating these conditions. This work, combined with examination of pathological specimens, and the analysis of clinical data covering the observations of many years, resulted in Goldthwait's publication in 1904[1], which has put the subject on a most satisfactory foundation. His classification has been accepted by a majority of workers as adequate for clinical purposes. It was first shown that this group of cases does not represent rheumatism at all, but is composed of a number of chronic joint diseases, which tend to progress unless checked by favorable influences. These cases present much similarity from the clinical side, and an accurate diagnosis is possible only when a complete Röntgen examination is made.

Etiology.—Most cases of chronic joint disease in which some bacteriologic agent cannot be demonstrated, are shown to be due to faulty metabolism. The absorption of putrefactive substances from the intestinal tract, especially the colon, causes a deposition in and around the joints, of insoluble substances which act as irritants to the delicate synovial membrane. The auto-intoxication resulting from the absorption of products of incomplete metabolism is often found to rest on a simple mechanical basis. Ptosis of the viscera, especially the stomach and colon, allows the food to stagnate, and torsion and partial occlusion of the intestines resulting from the ptosis permit the delay in the passage of food and so favor the absorption of toxines from the alimentary tract.

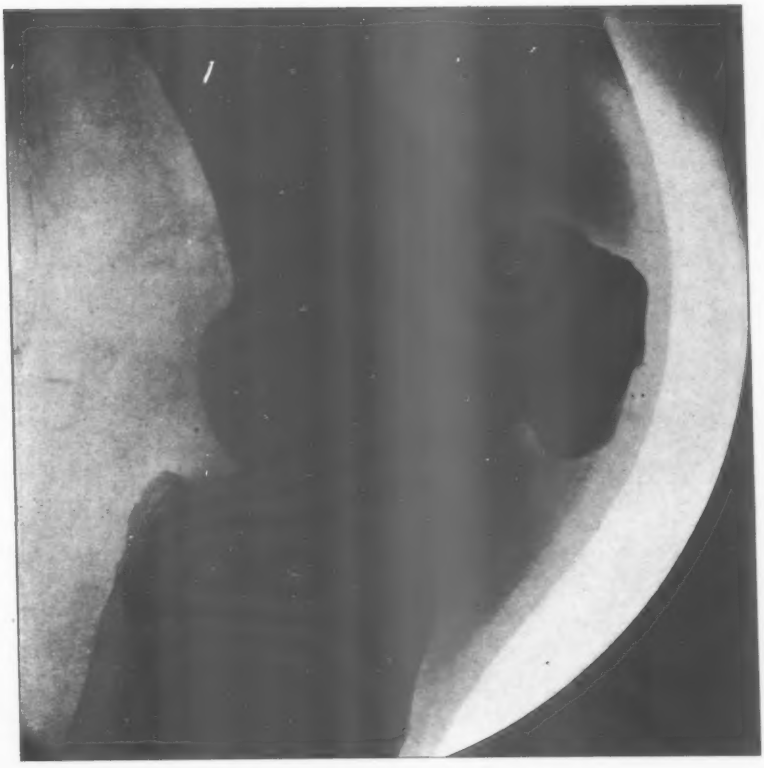


Fig. 1—VILLOUS ARTHRITIS
No bony changes. Thickening of soft parts beneath patella.

THE
JOHN CR
LIBRA

Great credit is due to the members of this Society, notably Hulst, Leonard, Pfahler, Pancoast and others, as well as the foreign workers, Rieder, Von Ziemssen, Holzknecht, Groedel, and many others, for calling attention to the normal position of the viscera in the standing posture of the body, and the observations on visceroptosis in a large series of cases. Last year at the meeting of this Society in Atlantic City, Dr. Percy Brown called attention, in an admirable paper, to the relation between bodily deformity and gastro-intestinal irregularities. The significance of this work was not fully appreciated at the time, but recently attention[2] has been directed to visceroptosis as a causative factor in chronic joint diseases. The ptosis may be congenital in some cases, at least the tendency to it is so considered. In a larger percentage of cases it is acquired, and is due to faulty attitudes of the body, relaxed conditions of the suspensory ligaments of the viscera, atonic muscular walls of the abdomen or skeletal deformities. These splendid contributions to living anatomy and living physiology promise to assume an important rôle in the future in placing these obscure diseases on a sound etiologic basis.

The first change noted in these chronic joint diseases is in the character of the synovial membrane. It loses its smooth, whitish, glistening appearance, and becomes roughened, reddish, and villous, giving rise to pain and stiffness, and revealing, on examination of the larger joints, the typical dry crepitus and the thickened, rubbery feel. This is the villous arthritis, most commonly seen in the knee. On Röntgen examination it shows only a thickening of the tissues beneath the patella in the lateral view, or a thickening of the soft structures at the sides of the joint. No bony change can be made out at this stage. There is a variable amount of fluid in these joints, due to local trauma from the villi catching in folds between the bones during motions of the joint. These villi often undergo fatty or calcareous degeneration and may become broken off and lie in the joint as "joint mice." This villous condition may be found in the early stage of any joint trouble, whether due to tuberculosis, purulent infection, or to the group caused by faulty metabolism, and commonly

known as rheumatoid arthritis. Villous arthritis is also the result of strain from flat-foot, relaxed sacro-iliac joint, or faulty attitudes of the body.

If the disease is progressive, it may go on to cartilaginous or bony changes, according to the etiologic factor at work. In the class of diseases which we are particularly considering, the so-called rheumatoid arthritis, the joint may take on one of two characters; it may become atrophic, or it may become hypertrophic, and at times both types are present together.

In the atrophic form the bone is thinned, in the later stages markedly so, and the space between the bones is much diminished, due to the loss of cartilage. This atrophy may progress until all the structures of the joint are involved, and one bone may even telescope into the other, or dislocations and occasionally ankylosis may result, with a small atrophied joint. The disease is slowly progressive, often attacking joints in rotation, and months or years intervening before the next joint is affected. Contractures may be present, and often this fact is a cause of error in examining Röntgen plates. If the joint is not flat upon the plate the space between the bones will appear less than it really is, a fact familiar to all of you. In operations for straightening contractured joints, such as genuclasis, the thin, atrophic bone may be readily fractured unless great care is used in handling the genuclast. This difficulty is not usually experienced in operations on infectious joints, such as the gonorrheal type, because here the bone is thickened and eburnated, and possesses much strength and elasticity. The hand better than any other joint illustrates the type of disease present. It is affected early, and should be examined by the Röntgen method when there is any doubt as to the exact condition. The first row of phalanges first shows the characteristic changes, but the other joints may be involved later.

On the other hand, the hypertrophic form of chronic joint disease is proliferative in nature, as its name indicates. The bone is of good texture, and no atrophy is found unless the mixed type is present. The bone may be denser than normal

Fig. 2—ATROPHIC ARTHRITIS
Showing marked atrophy, some destruction of bone, and telescoping in some joints.

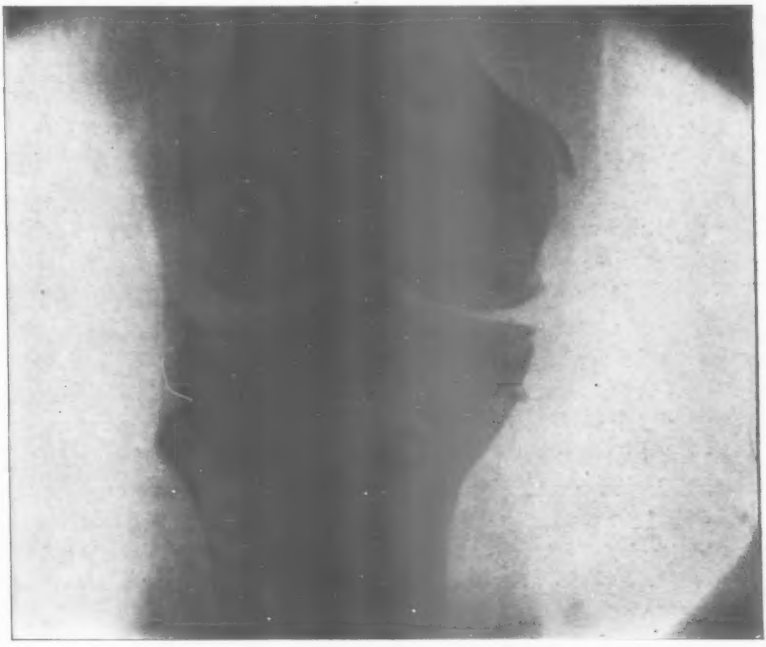


Fig. 3—HYPERTROPHIC ARTHRITIS
Note lipping on both femur and tibia.

bone. Lipping and bony excrescences characterize this group, and the phalanges of the hand, the condyles of the femur, the upper end of the tibia, the os calcis, and very commonly the patella, top and bottom, are affected. The same condition is found in the hip joint and along the front of the spine at the sides. These thickenings and ridges along the articular cartilages cause considerable interference with the joint motions and much resulting pain.

A group of cases closely allied with the above, and yet radically different in etiology, is that of infectious arthritis. The onset is abrupt, as distinguished from the atrophic type, but the involvement of the joints occurs rapidly following the invasion of the body by some micro-organism. The joints are usually affected about the same time, though one joint or several, and at times all the joints in the body share in the process. The joints may show no Röntgenologic change following an infection, and yet ankylosis may be present. The bone is of normal density and the cartilage shows no changes. These cases are probably due to the presence of toxines rather than bacteria. On the other hand, many cases show bone destruction or bone proliferation, probably caused by the presence of micro-organisms. In the repair of joints so diseased, new bone formation occurs at the points where infection was present, and not at the edge of the cartilage.

Chronic gout is liable to be confused clinically with some of the types of rheumatoid or infectious arthritis, and Röntgenologic and pathologic examinations are necessary to establish the diagnosis. The finding of urate of soda crystals in the deposits about the joints is sufficient proof of the nature of the disease. These deposits are not attached to the bone, and are softer than the bony excrescences of the hypertrophic form, with which they are most likely to be confused. The bony changes are interesting in that they are punched out and involve only a small area of the bone. Gradually the process extends into the rest of the shaft, either from one or both sides. All the bones in a joint are affected, so that the articulation is destroyed. The bone is atrophied, but not as

in the atrophic form, where the bony outline is preserved. In gout there is destruction of bone, and the bony outline is lost.

The arthritides due to tuberculosis, malignant disease, hemophilia, Charcot's tabetic joint and others all present interesting features, but they are beyond the scope of this paper.

I cannot refrain from adding a word on the modern treatment of this interesting group of diseases. Those of you who are also members of the American Electro-Therapeutic Association have frequent occasion to employ the various agents of physio-therapy in the treatment of these cases, and I can do hardly more than mention the various lines of treatment followed.

A plain mixed diet, as found on the ordinary family table, carefully masticated, and in sufficient quantities to satisfy the appetite, but avoiding excess, is the first requisite. Many cases are poorly nourished because they have been told to avoid red meat, acid foods, etc., and improve when put on a nourishing general diet.

Outdoor life, exercise in moderation, a dry climate, avoiding foggy and humid weather, and warm clothing are all desirable. Supports for ptosed viscera, pelvic belts in the case of men, and belts attached to the corsets in the case of women, are sometimes necessary to hold up the organs until they are capable, through efficient stimulative treatment, of supporting themselves. Gymnastic exercises with some form of apparatus should be used, either to reduce superfluous flesh, a disturbing factor in many of these cases, or to exercise and limber up certain joints.

Hot air baths, high candle power incandescent lamp, the all-over incandescent light bath, are valuable agents in certain types of these diseases.

The various static modalities, the wave current, brush discharge, local sparking, as well as the high frequency, D'Arsonval, auto-condensation, and auto-conduction currents from the coil or transformer serve to stimulate general metabolism and consequently the local joint conditions. General vibration of

Fig. 4—HYPERTROPHIC ARTHRITIS

the spine, liver and abdomen, followed by vibration of the affected joints, should be a part of any treatment, whether light, heat or electricity.

Ionic medication and Röntgen therapy have a place in the treatment, and the latter is often effective in lessening pain and reducing swelling. The injection of fibrolysin into the general circulation, and of sterile oil and vaseline into the joints are reported upon favorably by some writers.

The surgical treatment of these cases, while of value in special types of disease, is being used less and less, as it is becoming demonstrated that the various agents of physiotherapy bring about even better results.

In conclusion, I would urge the careful Röntgen diagnosis of all obscure joint affections coupled with a careful clinical examination, for both are essential and neither alone will give the complete and accurate picture.

References.

[1]Goldthwait, Joel E.: Boston Med. and Surg. Jour., Nov. 17, 1904.
[2]Goldthwait, Joel E., and Brown, Lloyd T.: Boston Med. and Surg. Jour., May 26, 1910.

DISCUSSION

DR. PERCY BROWN, BOSTON, MASS.

Only a word is necessary to add to such a complete presentation of this subject. It is easily to be seen that a classification of this sort must be received very slowly by the general medical world, consequently, I think it has taken some years for this new nomenclature of old "rheumatoid" conditions to be received properly, and even as yet it is not accepted by a certain proportion of orthopedists.

A word as to chronic joint trouble in general, and abnormality in position of the stomach and the large intestines, in particular. It seems a far cry between a lame knee and an ailing stomach. The relation between the two at first glance seems strange. It has been my good fortune to examine about 175 of Dr. Goldthwait's cases, in which he assumed practically that there might be some relation between the position of the stomach and a chronic joint lesion from which the patient was suffering. He would say that a patient might present

a sagging stomach, from what he gathered of her general attitude and physical deportment, to say nothing of whatever specific area might be involved. It was so in a large number of cases. As time went on I became more and more inclined to value the theory. It seems to me that there must be some direct relation between cause and effect. The work is only just begun and in a few years more there will be gathered much of value from it. It is found that where the stomach is low, the large intestine is also down, but it is also seen, so far as my observation goes, that the stomach **alone** may be the annoying organ, or that the colon **alone** may be the organ which is making mischief. Properly to classify the cases in which the stomach alone is the trouble-maker, or where the colon alone is the one to which we must look, will be the basis of my work for the year to come, and possibly I may have the pleasure of presenting some more dependable results on this work before long.

DR. CLARENCE E. COON, SYRACUSE, N. Y.

If the Röntgen ray had never done anything else than to help us to classify the conditions which we formerly called rheumatic affections, it has done well. The classification of these troubles is now in rather an arbitrary stage, but the work which Dr. Hammond has done is certainly along the line to enable us to arrive at something definite. All these processes, as shown by the Röntgen ray, appear to be different stages of one and the same primary cause, but I think that the condition is probably due to absorption and improper nutrition. First of all comes the intestinal tract. It seems to me that the source of infection, and in that case it would be an auto-intoxication, must in most cases come from a sagging transverse colon in which there is taking place absorption of the products of putrefactive fermentation. In the stomach there is not so much absorption. The fluid proceeds rapidly into the large bowel, as shown by many radiographs. The stasis takes place in the transverse colon and it is perfectly reasonable to believe that we get most of our absorption of putrefactive products from the material in the transverse colon.

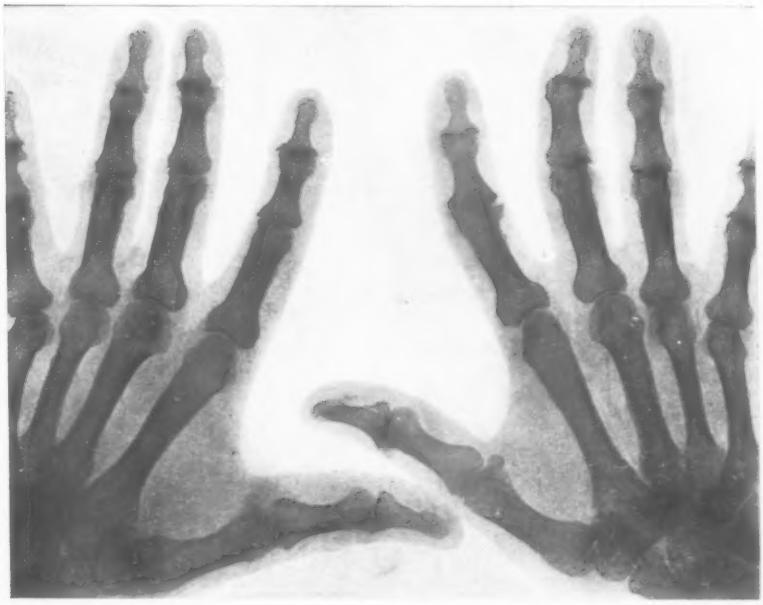


Fig. 5—ATROPHIC AND HYPERTROPHIC ARTHRITIS
Mixed type.

THE
JOHN CREAR
LIBRARY

THE RADIOGRAPHER'S PROPERTY RIGHT IN THE RADIOGRAM.

BY G. H. STOVER, M. D.
Denver, Colo.

You have all heard, and many times, the question asked by a patient after radiographic examination, "When may I have the picture?" Before I give you the reply I make to such an inquiry, there are a few prefatory remarks which I wish to make. I have a peculiar and strong feeling toward my negatives; they are my pride and my treasure. They are always wonderful to me because they show in life so marvelously by means of that invisible yet terribly potent ray, facts regarding the structures of the human frame whose secrets the healers of human ills have sought for thousands of years to lay bare; and here we have these facts revealed to us in an instant almost, at any time when we need to know them. My feeble eloquence would fall infinitely short of expressing the wonder, the marvel, and the awe that I feel in the presence of this great new light that has been given to us. Is it any wonder that I love my negatives and am jealous of them? That I will not relinquish them to other hands? That waves of apprehension and rage pursue each other over my frame when a confrere (greater villain than the umbrella fiend in an art museum) approaches with impious finger or pencil the very heart of the wet, soft film when I am demonstrating to him from a freshly made skiagram?

But there are other reasons than sentimental ones which impel me to insist that the skiagram is mine and mine alone, so far as right of possession goes.

So when a client asks me, "When do I get the picture?" I say to him, "You do not get a picture; there is no picture." He is rather surprised at this, as a rule, so I go on and explain. "I am not a photographer, and I have not been making a 'picture' of you. You have been sent to me as an expert in examining by means of the X-ray, in order to get my opinion

about certain things; in the course of forming this opinion, among other things that I do, I make a skiagram, but this is a very different thing from making a 'picture.' The skiagram shows certain things to me and I find out other things by other means of examination; the skiagram is not my opinion; I form my opinion partly from what information I get from a study of it and partly from other facts which I learn. I file these skiagrams away in a special room so that they will not be lost or defaced; then in future if any question comes up about your case we know where the skiagram is, and can refer to it."

I have so far found that this statement satisfies the patient that I am right and that his interest will be taken care of.

The skiagrapher is a medical expert and not a photographer; he has a much higher function than merely performing the mechanical act of producing a negative. And I am by no means belittling the skill required to make a perfect negative.

But far more than the ability to make a good negative is demanded of the Röntgenologist. In a former paper ("The Professional Position of the Röntgenologist") I have said: "For one thing, even though his work is not photography, he must be a pretty good photographer; for the reason that a good many of his mechanical procedures are based upon the chemical and manipulative methods first made use of in photography; he should understand the chemistry of his plates and developers, etc. He must be able to vary his formulae so as to produce various effects according to conditions present or results desired; he must be able to handle under-exposure and over-exposure, to prevent fog, to develop for contrast or for shadow detail; he must be able to intensify or reduce density; he must know how to vary his process according to the temperature in which he is working; he must know the short cuts for the removal of hypo, and for quick drying, and any number of technical points which must be known by the expert photographer.

"He must be a rather competent electrical engineer; he must understand the method of production of the electrical currents used in his machines, the characteristics of these various cur-

rents; he must be able to make many of the computations made by electrical engineers in the designing of apparatus; he must know about condensers and condenser action, shunt and series resistances, inductance, hysteresis, insulation, inverse discharges, rectification of alternating currents, or suppression of a phase, electrolytic and mechanical interrupters, electrolytic valves; must be able to distinguish the outside and neutral leads of a three-wire alternating supply; how to fuse a line properly; how to find broken or short circuits; how to test for polarity. These are just a few of the things he must know along electrical lines; there is not time to enumerate a quarter of the remainder. . . .

"The Röntgenologist must be a physician and surgeon. He must be able to make a proper estimate, many times, of the clinical symptoms of the cases referred to him in order that he may know what parts to examine and how to conduct the examination. He must know the pathology of many diseases in order to properly interpret the findings of his Röntgenograms, or in order to know what quality of ray to use. . . . His gastro-intestinal examinations require a knowledge of the physiology of digestion. He must be a good anatomist from the ordinary standpoint, and he must be thoroughly conversant with the appearance of normal parts as viewed by the Röntgen findings, and he must recognize pathological appearances in the various structures, and be able to differentiate between them. There is a vast difference in the treatment of syphilitic osteoperiostitis and that of osteosarcoma. The Röntgenologist must be familiar to a high degree with the growth and development of bones at different ages. . . . There is a host of facts with regard to appearances seen in Röntgenograms and their meanings which can only be acquired through wide experience, the study of many hundreds of skiagrams, and of the clinical symptoms which led to the examination, and a careful consideration of operative and post-mortem findings in cases which have been examined. How does a Röntgenologist know the difference between a sesamoid in the head of the gastrocnemius and a foreign body in the knee-joint? Or how does he know that a certain shadow found in

the examination for a ureteral calculus is not a calculus but a calcified gland or a phlebolith?

"The Roentgenologist must be posted in therapeutics and surgical treatment, for he is often asked for his opinion or advice as to treatment of disease or the handling of fractures, etc."

We must see to it that the qualifications needed in a competent Roentgenologist are understood and recognized, not as a matter of petty personal pride of professional position, but because grave mistakes will often be made by the unqualified, those who are merely photographers, and whose negative or skiagram only is the sole result of their services.

The surgeon does not give to the patient or the patient's physician the tape by whose use he arrives at the opinion as to whether or not there is shortening in a limb. The physician does not give up the stethoscope which he uses in forming an opinion as to the condition of the lungs. And there is no more reason why the Roentgenologist should give up his negative to the patient or the patient's physician than there is for giving them the Crookes tube he has used or a leaf from the book in which he keeps his written record of the examination, for this skiagram is an integral and important part of his record, and is no more useful or readable to the patient or consultor than those written notes of technique would be. That record in its completeness should at all times be in the keeping of the Roentgenologist, for he is liable to be asked at any time some question about a patient that he has examined in the past, and if his skiagram is gone how can he refresh his memory fully? Where a number of skiagrams are taken at various times during the progress of a case the Roentgenologist must have all of them at hand for purposes of comparison in order that he may give an opinion as to the character of the changes that are taking place. Long after the details of a condition may have passed out of his mind, he may be called to testify in court. How necessary then to have the skiagrams at hand for reference.

Of great value to any Roentgenologist is the possession of a large collection of skiagrams which may be used for scien-

tific study; there are a great many things yet to be read from skiagrams; if the question of the property right in skiagrams should ever come into court, the law should give great weight to this proposition alone.

It was a great satisfaction to me some time ago to be able to go through my collection in aiding Dr. Pancoast in his research regarding the sesamoid of the gastrocnemius. No prints or lantern slides can take the place of the original skiagram for study.

Photographic questions have appeared in the courts a number of times, but the question of the ownership of the negatives has been a very unimportant feature of the cases; all have hinged upon a violation of contract, usually of an implied nature, or upon a libelous use; the question of a right of privacy against the publication of photographs has also appeared; but in none of these cases, even where an improper or libelous use of an individual's photograph was alleged, was there a single effort made to obtain possession of the negative.

In a general way it would seem to be granted that the negative is the property of the maker of it, but the maker of it would not be permitted to make such use of it as to reveal the frailties of the other party to the transaction. I take it that the courts would consider that the skiagram is the property of the radiologist, but that he must not use it in such a way as to violate the confidential relation that is established by the making of the examination.

The individual who goes to a photographer does not go for the final purpose of having a negative made; his object is to have photographs or prints made. The negative made by the photographer is simply a means to the desired end of the transaction.

The individual who goes to the radiographer goes for a professional service, to obtain the scientific opinion of the radiographer regarding certain conditions. The skiagram is one of the means used in arriving at the desired end, the expert opinion. And the skiagram is a far less complete part

of the radiographer's process than the negative is in the photographer's process. Given a photographic negative, any expert photographer could make perfect photographs from it. But the expert radiographer could not take every radiogram and give a correct and complete opinion from it as to the patient's condition every time, because every radiogram does not have the complete information upon which to base a correct opinion.

I have been required a number of times in medico-legal cases to show skiagrams to juries. I have always said to the judge before beginning my statement to the jury, that these skiagrams are a part of my records of the case, and that I did not wish the skiagrams to be filed as exhibits in the evidence, but wished only to use them for purposes of demonstration. This proposition has always been accepted by the judge and no protest has been made by the attorneys for either side.

To sum up then: The transaction between the Roentgenologist and the patient has for its actual object the furnishing of a scientific opinion by the Roentgenologist.

The skiagram contains only a part of the information upon which the opinion is based.

The skiagram is a part of the Roentgenologist's record of his study of the patient's case.

The interest of the patient in so far as it appertains to the skiagraphic record will be better conserved with the skiagram in the hands of the scientist who understands it and appreciates it and who has a proper means of preserving it, than in the hands of the patient to whom it is a mere temporary curiosity.

The value of the skiagram to the patient, as a mere object of curiosity, is greatly overbalanced by its value in the hands of the Roentgenologist as a scientific record to be preserved and studied and to be used for the further advancement of the science of healing.

PHYSICS AND OPTICS OF STEREOSCOPIC ROENTGENOGRAPHY.

BY H. CLYDE SNOOK, B. Sc.

The object of this paper is to make a brief survey of the physical and optical principles involved in the making and viewing of stereoscopic radiographs. It is therefore not within the scope of this paper to discuss the mental process whereby the brain of the observer welds into one the two images received by his eyes.

The exact conditions to be fulfilled whereby this mental fusion may be made correctly and with ease to the observer have been, in my opinion, a matter of too little regard by Roentgen experts both in America and in Europe.

I believe that the tables of Marie and Ribaut, which have been quoted and published in the best works on Roentgenology, have been largely responsible for much incorrect and mediocre stereoscopic work.

These tables give a list of varying distances for the movement of the X-ray tube between the two exposures. I think these tables to be incorrect and have made a series of experiments to test their validity. My experiments show that the use of these tables leads the observer to make false estimates of the depth of objects and produces wrong images of the objects with loss of definition in the resultant fused images.

By the use of these tables one will, in the majority of cases, receive an impression of depth less than the real depth of the object examined. In a few cases the apparent depth will be greater than the real one, and in still fewer cases will the real depth be the same as the stereoscopic impression.

The tables of Marie and Ribaut state that in the case of an object 2⅜ inches thick when the tube is 12 inches away from the upper surface of the object, the tube should be moved 1¾ inches between exposures. I made such a pair of plates, using as an object a wooden block—an exact cube—

coated with litharge so as to get images of all six sides of the block. When viewed in a Wheatstone stereoscope with the optical path from the plates to the eyes the same as the beams of X-rays at the time of the exposures, these plates gave a resultant stereoscopic impression of a rectangular block of wood, less thick than it seemed long or wide. That is, the apparent depth was less than the real depth.

I then made a pair of plates, keeping all conditions the same as just stated with the exception that the tube movement between exposures was 2½ inches. On viewing this pair of plates the block of wood seemed to be just as thick or deep as it was long or wide. That is, it seemed to be a cube without any distortion whatever.

The Marie and Ribaut tables state that with the tube 12 inches from the upper surface of an object 4 inches thick, the tube ought to be moved 15 or 16 inches.

A pair of plates made in this manner with a 4-inch cube of wood, and then viewed in the stereoscope gave a stereoscopic image flatter than a real cube; but a pair made with a 2½-inch tube displacement between exposures gave the stereoscopic effect of a real cube.

An object 6 inches thick, according to Marie and Ribaut, with the tube 15¾ inches from the upper surface of the object, requires a cube displacement of 1⅛ inches. My pair of plates made in this way, of a 6-inch cube of wood, shows a flattened stereoscopic image; whereas the pair made of the same cube with a 2½-inch tube displacement gives a true impression of a perfect cube.

I have made a pair of plates of the 2⅜-inch cube with a 4-inch tube displacement at 12 inches from the upper surface of the cube. This gives a stereoscopic effect of greater depth than a real cube. This pair makes the block quite tall as compared with its length or width and is a striking contrast to the first pair of plates I have described which were made of it according to Marie and Ribaut and which made the cube appear flattened.

The incorrect impression of depth—relative depth is here involved as well as total depth—is a very serious matter when

we remember that even mechanics who are skilled in estimating distances by mere inspection are unable to maintain a constant degree of accuracy in their estimates of distance and depth.

A good figure for the average distance between the centers of the pupils of the eyes is 2½ inches. I think that the tube displacement in all cases should be 2½ inches—no matter what is the thickness of the object. I have several reasons for reaching this conclusion, one of which is the results obtained in the experiments just outlined. Another reason is that the best sets of stereoscopic radiographs of human subjects that I have seen have been made with a 2½-inch tube displacement.

Then, too, I think that it is correct on the basis of theory. The radiograph is a projection of many objects on a plane, the projection being made from a common point for all the images.

A pair of stereoscopic radiographs is two such conglomerate sets of projections obtained from two separate points of projection.

If the angles with which the different images were made are different from the angles with which the observer's eyes receive the images it seems evident to me that incorrect stereoscopic fusion of the images must result; for the stereoscopic vision of an object in space depends on the reception of two sets of images obtained by projection from the centers of the lenses of the eyes and upon which the different angles of the different objects depend.

I believe, therefore, that in viewing stereoscopic plates, the eyes should replace the focus spots of the tubes. This is possible only when the tube has been moved the distance between the eyes, which as previously noted is 2½ inches for average eyes. In order to fulfill this requirement, it is also necessary that the optical path from the eyes to the plates be the same, as from the tube positions to the plates.

An interesting change in the apparent depth of an object can be produced by changing the optical distance between the eyes and the plates. In the case of correctly made plates

a reduction from the true depth is produced by making the eye-plate optical distance less than the tube-plate distance and conversely the apparent depth is made greater than the true depth by an eye-plate optical distance greater than the tube-plate distance.

In the case of pairs of plates made with a tube displacement different from the 2½ inches, the incorrect impression of depth can be overcome by giving the eye-plate optical distance a value different from the tube-plate distance.

In the case of the apparent flattened and elongated cubes taken according to Marie and Ribaut, one can make the apparent depth correct for a small portion of the plate and in the case of small objects the effect is good; but the outer portions of large plates do not give good "focus," i. e., the images are distorted and do not superimpose except in one part of the plate at a time.

It should be remembered that for the sake of uniformity and convenience the line in which the tube is moved should be parallel to the plane of the plate and should be bisected by a vertical plane passing through one median line of the plate, while the projection of the line on the plate should lie in the other median line of the plate.

It should be recognized also that the object should not move between the exposures, otherwise the second plate will contain images of the parts giving incorrect visual angles and resultant false stereoscopic distances.

Now, assuming that the tube was correctly placed at the times of the two exposures, and assuming that there has been no loss of detail during or between the exposures, we are confronted by the problem of giving correct optical replacement to the focus spots of the tubes by the eyes.

We have available several types of apparatus, each of which has its own practical objections. Walter's stereoscope utilizes the plates mounted in a common plane adjacent to each other and enables the observer to view them through a pair of prisms or lens-prisms. The chromatic aberration with this type of stereoscope is exceedingly objectionable, because

it gives highly colored fringes to all the bright portions of the plates.

There are several types of hand-prism stereoscopes, but they all have in common the serious objection that the eye-plate optical distance is not definitely predetermined and held fixed while the observer is viewing the plates. And also since they depend upon the observer's hands for support the field of vision is unsteady, making the observation difficult for most individuals.

The Whetstone stereoscope has the objection of producing a reversal in all the horizontal planes, making it difficult not to confuse a stereoscopic view of the right hand with one of the left hand, of the right foot with one of the left foot, etc. Then, too, the Whetstone and the Wenckebach stereoscopes suffer from the presence of the double images produced by the mirrors.

In all of these stereoscopes the best results are obtained when the eyes of the observer most nearly bear the same optical relation to the plates as did the focus spots of the tubes when the plates were made. Under such conditions the eye strain is the least and all parts of the object are in so-called "focus." Under other conditions, only a small portion of the object can be seen without change of the adjustments of the stereoscope or change in the "accommodation" of the observer's eyes.

It is remarkable to me to find the very great power of "accommodation" which some persons possess. Almost everyone can be taught to see stereoscopic radiographs, although it sometimes takes considerable patience and careful study of the new observer's eyes. One eye is often weaker than the other. The plate seen by the weaker eye should be illuminated a little more strongly than the other one. If the observer wears glasses for reading they should be worn in observing stereoscopic plates, because the virtual images of the object are at reading distances from the eyes. In this connection, I wish to observe that the greatest stereoscopic effect is obtained with ease to the observer when the distance from the focus of the tube to the near or upper surface of

the object is the shortest easy reading distance. The oculist's standard reading distance is 14 inches. I believe that on account of the necessity for securing the maximum stereoscopic effect the distance from the tube focus to the upper surface of the object should be a constant distance—say not over 14 inches and not less than 12 inches—thereby making the tube-plate distance equal to this constant distance plus the thickness of the object.

For accuracy and convenience in the reading of plates they should bear records of their tube-plate distances. It is convenient also to use the "foot points" of Eykmann in checking up the tube positions so that the observer's eyes may be correctly positioned when viewing the plates.

I wish to urge a word of caution in the matter of the use of bismuth, lead oxide or other substances which are spread on the surface of the skin to outline it in space. It is my experience that these substances ought to be used in such a way as to show detail and landmarks instead of a uniform opaque layer because too much of it in uniform layers blots out important shadow detail of underlying tissue, and, on the contrary, too little is of no value.

The use of layers of opaque paste or powders to outline the skin surface over deep parts is not nearly so successful as on limbs and extremities. A paste of bismuth salt and vaseline spread on ordinary gauze wound around an arm or leg gives excellent detail of the meshes of the gauze for outlining the surface of the skin; while the detail of the skin itself, in the case of hands and feet, is sufficient when the paste is smeared on and rubbed into the folds and creases of the skin.

In closing, I wish to emphasize the fact that I am well aware that stereoscopic plates can be and are mostly made without regard to any fixed rules. I know that such plates give stereoscopic effects and look beautiful; but I wish to say that I think such haphazard methods are not right and will not promote excellence or accuracy in stereoscopic work.

CASE OF PROSTATIC HYPERTROPHY; SYMPTOMATIC CURE BY X-RAY AND HIGH FREQUENCY CURRENTS.

BY SINCLAIR TOUSEY, A. M., M. D., NEW YORK.

The patient, I. A., was about sixty years old when the urinary trouble began, and was examined by Dr. Keyes, whose diagnosis of hypertrophy of the middle lobe of the prostate has since been confirmed by other urologists. The symptoms have been more those of irritation than obstruction. There has been some retention, but he has never used a catheter more than three times. This was attended by so much distress that it was abandoned, fortunately without infecting the bladder. He went along for a number of years without much trouble, but when he was referred to me, ten or twelve years after the onset of the trouble, he was obliged to get up from ten to fourteen times during the night. There was no pain, but he complained of a numb feeling at the neck of the bladder.

The treatment consisted in applications of the X-ray through the perineum, and of high frequency currents by a vacuum electrode applied to the perineum and hypogastrium successively. The X-ray tube was a Machlett Ideal tube actuated by a 12-inch Wappler induction coil with a mechanical ("wheel") interrupter with a rheostat transmitting about 4 amperes. The current through the X-ray tube was 1 to 2 m.a. The penetration of the X-ray was of about 6 Benoist and the intensity such that exposure of 24 minutes at a distance of 13 inches equaled a Sabouraud and Noire dose or about 5½ Holzknecht units. The effect was modified, however, by the interposition of a screen of heavy sole-leather which arrested most of the rays which would have been absorbed by the skin and transmitted most of those which could penetrate the flesh deeply enough to affect the prostate. A greater effect was made possible with reduced danger of dermatitis. The X-ray tube was in a Ripperger

Shield, a protective opaque box with a cylindrical orifice 4 inches in diameter which pressed against the perineum. The anticathode was 13 inches from the skin. The X-ray exposures on March 25, 28 and April 3 and 7, 1910, were of seven minutes each. After the last date the exposures were of two minutes three times a week and the last treatment was on June 1st. The high frequency vacuum electrode was a dome-shaped one for external application and had a leading-in wire. The current was a unipolar one derived from a small Guilleminot spiral, the equivalent of a Cudin resonator, and was of 200 or more milliamperes with very little spark-effect. This made the glass quite hot if applied for any length of time. The electrode was moved slowly over the perineum for two minutes and then over the lower part of the abdomen for five minutes. A somewhat longer application to the perineum at the first treatment produced symptoms of overstimulation. The high frequency applications were made at the same sessions with those of the X-ray.

Except for a week or two while the patient had grippe or a severe cold, favorable progress was rapid and uniform and at the time of the last treatment he was getting up to urinate only two or three times a night and could make the seventy-mile railroad trip from his home to my office without discomfort and without having to urinate. At no time was there any dermatitis or any change perceptible in the normal dusky red skin of the perineum. The scrotum, of course, was always shielded.

It transpired that the patient had long experienced pain in the testes and urethra, but a radiograph showed the absence of prostatic or other urinary calculi.

PRIMARY LYMPHANGEIO-SARCOMA OF THE LUNGS.

REPORT OF A CASE.

BY A. L. GRAY, M. D., RICHMOND, VA.

While primary malignant disease of the lungs is unquestionably a condition of very great rarity, it is highly probable that were all of the facts known, miliary tuberculosis would have to surrender to this malady some of its mortality percentage.

The meager literature on this subject renders it difficult to obtain satisfactory statistics. Primary carcinoma is relatively more frequent than is primary sarcoma. West, quoted by Osler in his **Modern Medicine,** has collected five cases of primary sarcoma of the lungs, of which four were men, the sex of the fifth not being stated.

The case that I report was referred to me for Röntgen examination on June 8th of this year by Dr. Manfred Call. Two exposures were made, front and back respectively, with the patient in the sitting posture. The appearances seen were so typical of extensive miliary tuberculosis of both lungs, that despite the lack of harmony of the pathological and clinical findings with this condition, I made this my unqualified diagnosis.

The history of the case, obtained from Dr. Call's records, is as follows:

C. T.—White, male, age 27, single, salesman for an electric company, native of Virginia, residing in Chicago for the past six or seven years. For the past three months has had a persistent and annoying hacking cough; has had similar attacks each winter and summer for six years. The previous attacks have followed a severe head cold, which "settled on the chest." The present attack was not preceded by the customary head cold, but has persisted as a hacking cough for two months.

One month after onset of the present attack, he began to experience loss of appetite, "liver became sluggish" and his energy disappeared. Felt so bad he remained indoors for a week, then returned to light work for about three weeks.

Personal History: Negative, save for slight attacks during childhood. Confinement with present illness first in ten years. Patient denies venereal disease.

Family History: Father died at the age of sixty years of cardio-vascular renal disease; mother living and well; two sisters both living and well; no brothers.

Present Condition: Is well formed, but shows evidence of loss of weight. Has weighed 140, three years ago. Color, fairly good; some pallor of mucous membranes. Appetite gone, bowels regular, stools normal, micturition normal.

Hacking cough persistent, especially at night, disturbing his rest, but sleeps well when cough permits. Cough recurs in paroxysms and is attended with intense pain on both sides of front aspect of his chest.

Expectoration of moderately thin, white frothy mucus. Considerable "post nasal dripping," no haemoptysis. Dyspnoea, oedema and vertigo absent. Visual and oral apparatus normal. Skin lesions absent.

Physical examination shows the patient to be well-proportioned and of symmetrical muscular development, but somewhat anaemic, with evidence of wasting. Two glands, the size of almonds, found in the right supra-clavicular region. Glands freely movable under the skin, markedly hardened.

Heart appears normal.

Lungs, expansion equal on both sides. Littens phenomenon, present and equal. Slight impairment of resonance in left supra-clavicular region. Numerous dry rales in left interscapular and suprascapular regions.

Abdomen, negative. No masses, tenderness or rigidity.

Temperature, 98° F. Pulse, 80, regular and of good volume.

Small nodule just above left testicle. Right tonsil in condition of chronic hypertrophy.

Urine, slightly turbid; sp. gr., 1028; reaction, acid. Trace of albumen; no sugar.

A few renal epithelial cells and leucocytes; no blood; no casts. Leucocyte count shows polynuclear cells, 80%. Large lymphocytes, 18%; small lymphocytes, 2%.

Patient was sent to the country. Upon his return, after a few weeks, emaciation had continued, and he had greatly lost ground. He was admitted to the Memorial Hospital on June 1st. Physical examination at this time elicited marked impairment of resonance in left apex, reaching to third rib, a few scattered rales in the same locality. Pleural friction sounds were audible in lower axillae on both sides.

Three specimens of sputum failed to show the tubercle bacillus. Two leucocyte counts were made, the first showing 19,200 per cu. mm., polynuclears 89%, lymphocytes 11%. The second, made four days later, showed 22,000 per cu. mm., polynuclears 86%, lymphocytes 14%. Widal, negative.

Specimens of urine examined at various times after his admission to the hospital showed albumen, renal epithelium, granular casts, pus and blood cells.

On June 15th, one of the glands in the supra-clavicular space was removed and submitted for pathological examination to Dr. E. G. Hopkins, who rendered the following report:

"Specimen consists of a neoplastic growth of interlacing columns of cells, supported by distinct connective tissue stroma. The cells of the neoplasm are polymorphous, chiefly polygonal and spindle. The nuclei of the cells are large and oval. Karyokinesis is not infrequently found. The protoplasm of the cells is relatively small in amount and non-granular. Diagnosis: Lymphangeio-sarcoma."

Patient died on June 19th. Unfortunately an autopsy was not obtained, but the evidence afforded is conclusive.

312 E. Franklin St.

OBSERVATIONS OF CASES OF CONSTIPATION AND OBSTIPATION BY MEANS OF THE ROENTGEN RAYS.

BY ARTHUR HOLDING, M. D. ALBANY, N. Y.

We have arrived at that stage of the world's career in which the inhabitants of each municipality are planning for themselves a "city beautiful," and certain idealists with imagination (in olden times they might have been called "prophets") are talking about a "country beautiful," and, last of all, a "race beautiful." This is simply a logical progression, an application of the same principles to successively higher objects.

The first step in beautifying a city must be adequate sewage disposal and when we come to beautifying the human race we must start at the same problem. While the "Old Guard" and the "Black Horse Cavalry" of fashion is furbishing the outside by running the gamut between hobble and hoop skirts; between impossible hats and none at all; between "rats" and bald heads; between sheath skirts and numerous accessories to give the bumpy contour of an exaggerated Junoesque figure; between bloom natural and the drug store variety, etc., etc., the "progressives" of hygiene must devote their attention to the inside problems which are the real causes underlying those distressing symptoms of lack of figure, flat chests, round shoulders, curvatures of the spine, pale, pimply, pasty and yellow faces, bald heads, obesity, morbid psychology, bad teeth, catarrh, poor eye-sight, pronated feet and other outward signs of inward neglect which drive us to the beauty shop, the tailors, the drug store or the specialist instead of to out-door exercise, co-operation with our physiology and "to-bed-o'-nights."

To take up the matter of sewage disposal in man, there is no better way to find out the lines of his "plumbing" than by making an examination with the X-rays. It is the most accurate way of observing the patency, the motor function

and localization of intestinal obstruction. I will not burden you with the description of technique of bismuth examinations, for it has been fully described by others. Suffice it to say that in my observations I have used bismuth oxychloride suspended in zoolak or mucilaginous mixtures by mouth and per rectum, respectively.

Previous to the examination, the patient should have thorough catharsis on three successive days. After the bismuth is administered, the patient should be examined in both the erect and the prone position, employing fluoroscopy for general orientation and observation of peristaltic activities. This can be done in perfect safety. Such permanent records as are desired are then made by skiagraphy, usually with the patient in the erect position and with a screen so arranged that the intestines may be observed fluoroscopically while the exposure is being made. Valuable information can be obtained by palpation of the patient's abdomen while observing the bismuth shadows. (Needless to say, I let the other fellow do the palpating). By this method of observation, we encounter another shock of disillusionment in regard to text-book statements. You have listened to the descriptions by learned members of this society, of the various collections they have found in their patients' abdomens in lieu of the classic stomach described by Gray and other anatomists. For instance, the "cow's horn," the "fish-hook," the "drain-trap" stomachs. The variations found in the intestines, including peristalsis, are quite as irregular but as yet they have not been described as poetically. I have purposely omitted to mention the Röntgen examination of the stomach (which is the first stage of a Röntgen examination in cases of constipation) as it has already been adequately described.

Fig. 1—The text-book outlines of the colon and viscera.

Fig. 2—The normal outline of the colon as it is found in life, patient standing erect.

Fig. 3—Shape of colon in atonic constipation—M-shaped colon.

Fig. 4—Shape of colon in atonic constipation—V-shaped colon.

Fig. 5—Extreme case of M-shaped colon with dilated stomach.

Fig. 6—Diagram showing sharp angulation at the recto-sigmoid juncture, caused by dropping of the sigmoid flexure over and into the right side of the pelvis. (Gant.)

Fig. 7—M-shaped colon after Lane.

Fig. 8—Loci of retention of bowel contents.

Fig. 9—Spastic constipation.

Fig. 10—"Lake Constipation."

Fig. 11—Same case three days later showing that the middle of the faecal stream had passed on, leaving residue along sides of the intestine, so-called "back-waters" of the intestine.

Fig. 12—A Rose abdominal support that exaggerated instead of corrected ptosis.

Certain general facts learned from observation of cases of constipation are worthy of mention:

I. In nervous patients we frequently encounter hyperperistalsis.

II. As a rule there is little delay in the transmission of the intestinal contents from the pylorus to the caecum.

III. The colon is largest at the caecum and grows progressively smaller as it approaches the rectum.

IV. The commonest sites of delay in the progress of intestinal contents through the colon are: 1, at the caecum; 2, at the sigmoid flexure; 3, in the transverse and descending colon; 4, in the ampulla of the rectum.

V. The commonest sites of obstruction in the colon by tumor are: 1, at the splenic flexure; 2, in the sigmoid; 3, at the hepatic flexure.

VI. Constipation has become so prevalent that the caecum seems to act as a retention reservoir into which the intestinal contents are discharged fairly promptly in most cases but from this point on, excretion seems to have become more a matter of mechanical extrusion than a matter of peristalsis. I have frequently been moved to call this apparent stasis and evident distension and accumulation of faecal matter at the caecum as "Lake Constipation." This stasis must have a very important bearing on the frequency of appendicitis.

VII. The marked difference in the position of the colon in the prone and erect positions makes one seriously question the Divine Architect's wisdom when he allowed evolution to raise man from all fours to stand upright upon his hind legs.

VIII. The fallacy of the so-called high enema; on introduction of fluid beyond the sphincter, the fluid will go rapidly to the caecum unless obstructed by bowel contents or a narrowing of the lumen of the intestine.

IX. The faecal current is like any other current, the center moves faster than the sides and collections of bismuth will frequently be observed for many days after the bulk of the bismuth has been evacuated.

X. The accurate localization of delayed transit in the faecal current, or kinks or flexures, in the intestines, or obstruction has an important bearing on the treatment of the individual case; prompt passage to the sigmoid flexure with constipation indicates enemata, proctoscopy, investigation of Houston's valves, O'Bierne's sphincter. Prompt passage to the caecum with constipation indicates the addition of massage to other treatments. Obstipation, sharp angulation of the colon, stenosism, congenital hypoplasia, with or without tumor formation, with delay in the faecal advance at a constant point may indicate surgical intervention such as intestinal anastomosis.

XI. Colectomy in cases of ptosis seems unnecessarily radical; the writer has found the various hydriatic, mechanical, pharmaceutical electrical and less radical surgical methods have been adequate in all cases so far observed without resorting to colectomy.

XII. Observations on the human appendix corroborate Cannon's observations on the appendix in animals, i. e., that anti-peristaltic waves pass the contents of the caecum into the lumen of the appendix.

EDITORIAL.

The excessive hot weather repressed all editorial writing except the enthusiastic announcement concerning the coming annual meeting. All indications point to a largely attended convention which it is hoped will surpass all others in attendance and work. The program now being prepared by the President and Secretary promises to be most interesting and profitable. The announcements in the public press of Richmond concerning "coming convention of Roentgenologists" show that the local committee is alive and working hard to prepare for the entertainment of the visitors. The financial success which attended the manufacturers' efforts at the last meeting is good ground for believing that they will be well represented.

ABSTRACTS FROM ENGLISH LITERATURE

ROENTGEN RAY DIAGNOSIS OF CARCINOMA OF THE STOMACH AND BOWEL.

Pfahler (Medical Record, Mar. 25, 1911, p. 528) believes that we have in this method the most positive means yet devised for the recognition of carcinoma in any stage of the disease.

Standing next to exploratory operation, it is, in the hands of an expert, accurate, painless, and harmless.

Pfahler is "impressed with the great value of the fluoroscope in gastrointestinal disease. We are able to see the food enter the stomach, the course of which enables us to judge the outline, position and tone of the stomach, the effects of the peristaltic waves, respiration, abdominal contractions and massage, all of which must be practically ignored if the plate alone must be depended upon. Both are indispensable for accurate diagnosis." Following detailed description of the Roentgen appearance of varying phases of the disease, Pfahler concludes: a positive diagnosis can be made in nearly every case in which an indurating carcinoma is present.

In some cases in which good peristaltic waves are present a negative diagnosis can be made.

A positive diagnosis depends upon some interference with the peristaltic waves, encroachment upon the lumen of the stomach, interference with its motility, or some interference with the functions of the pylorus. These may occur singly or combined. Nothing short of an exploratory operation can give nearly as much positive and definite information, though other physical and chemical examinations must not be neglected.

Each interpretation should be made in the light of the history and other clinical data.

These examinations must be made most carefully and by a trained observer to be reliable.

In the hands of the expert, there is no danger to the patient and to the operator only so far as he must expose himself during the examination. Therefore, the trained eye in making quick judgment and skill in manipulating the instruments will go far in reducing the exposure. D. R. B.

COLON OBSERVATIONS.

Coon (N. Y. State Journal of Med. Mar. '11, p. 116) adds to a review of the literature his own observations concluding, "The passage of food through the digestive tract requires about 24 hours, from 16 to 18 of which it is in the colon. The material enters the colon as liquid and leaves it as solid. If the time is unduly prolonged, putrefactive fermentation occurs and its products are absorbed.

"Some degree of ptosis of the transverse colon does not appear to be imcompatible with apparent perfect health.

"The stomach may be normal in shape, size, and position and the colon be way below its normal position.

"Most chronics and particularly chronic rheumatism and neurasthenia should have the colon located." D. R. B.

STONE IN THE URETER.

Bryan (Surgery, Gynecology, and Obstetrics, Feb., '11, p. 135) considers this subject from all sides, concluding with a bibliography which may well serve as a model of completeness, arrangement, and utility. Five radiographic plates by Gray illustrate the article. Bryan believes that in the X-ray we possess the most reliable means for diagnosis of ureteral calculi.

Aside from recording the number, size, and location of the stones in the affected side, the unsuspected kidney and ureter are shown up, for stones are frequently bilateral.

The reliability of the X-ray in the hands of a skilled

operator can not be gainsaid. A method which offers such positive claims and results, so economical, mechanical and determining in its character as the X-ray, can not be given a minor place in cases of even suspected stone.

In negative findings exploratory operation is not precluded. In positive findings it determines us how and where to operate.

D. R. B.

ROENTGENOGRAPHY.

Fenwick (Brit. Med. Journal, Apr. 1, '11, p. 748) begins with the assertion that no truly over-mobile kidney exists without a thickened capsule, and that all kidneys with a thickened capsule appear in the radiograph as "dense" kidneys.

Without disturbing the relations between patient, tube, and plate Fenwick makes three negatives. Oxygen is used to aid the respiratory acts. The first, taken with forced expiration, is labeled "expired supine;" the second, with forced inspiration, "inspired supine," and the third, with table tilted 45 degrees or more and with forced inspiration, is labeled "inspired erect."

The first plate is now illuminated and, with a black pencil, an accurate tracing is made of each bony outline and of the kidney, the stone if there be one. This tracing is now superimposed upon plate two. If the outlines can not be made to superimpose accurately the examination is a failure. This tracing is made with red and in the same manner the kidney shadow on the third plate is made with blue.

"By this method I can usually avoid the mistake of false shadows. True shadows in the kidney move with the kidney." No movement at all indicates a fixed kidney and the knowledge of it is of real value in surgery.

A fixed "dense" kidney with profuse hematuria indicates carcinoma that has passed through the capsule and so fastened the kidney that operation is useless.

No mention is made of the previous work of Lange.

D. R. B.

THE X-RAYS IN TREATMENT.

Riddell (Brit. Med. Journal, Apr. 29, '11, p. 985) gives his technique in terms of the Holzknecht radiometer for the treatment of rodent ulcer, keloid, psoriasis, lupus, tubercular glands, exophthalmic goitre, alopecia areata, leukemia, hyperhydrosis, pigmented moles, nevi, deep-seated malignancy, ring-worm and favus. Riddell also makes use of a method of measurement by the milliammeter and a mechanical counter to register the number of impulses from the (mechanical) interrupter. This method he checks from time to time with the H. radiometer. D. R. B.

ABSTRACTS FROM FORTSCHRITTE AUF DEM GEBIETE DER ROENTGENSTRAHLEN

Anatomic Contribution to the Interpretation of Lung Structure on the Radiograph.

By Hasselwander and Bruegel.

An anatomic study of the exact position, and method of division of the bronchial tree was undertaken in the hope of identifying the various shadows seen on the radiograph, and establishing their anatomic bases. The authors deplore the fact that there is no accepted anatomic work upon the bronchial tree especially with reference to the smaller peripheral divisions and with reference to the relations of the bronchial tree to the pulmonary veins and arteries. To avoid the confusion of shadows seen upon skiagrams of lungs injected solidly with opaque materials, the authors insufflated zirconium oxid into the air passages. The fine powder coats the walls of the bronchi and gives a delicate and very complete outline of the entire tree without obliterating any branches by superimposition of shadows. The pulmonary arteries were then injected solidly and their relation to the bronchi studied. In similar manner the pulmonary veins were injected. In their efforts to establish an anatomic system of the bronchial tree which would apply to the skiagraph, lungs were inflated and immediately frozen, hardened in formalin and then sectioned serially. Although it was found that a complete tracing out of the bronchial tree in the human was extremely difficult owing to its complexity, in the swine's lung the matter was much simpler. They conclude that the distribution of the bronchial tree in the chest follows a definite system, and that localization of single branches on the radiograph is possible. The arteries and veins follow the bronchial divisions closely and have definite relations to them. The arteries lie above (cephalad) the bronchi while veins lie on the opposite side to the arteries (caudad).

The lymphatic system likewise accompanies the bronchial tree but owing to its small calibre is invisible upon a skiagraph of an absolutely chest. In the average chest however evidence of the lymphatic system is seen in the small nodes and slight thickenings along the bronchial tree.

Dislocation of the Tarso-Metatarsal Joint.
By A. Ziegler.

Three cases of dislocation of the so-called Lisfranc joint are described. The condition is an unusual one and consists in an outward (lateral) displacement of the foot on the tarsus with or without fracture of the base of the second metatarsal or a fracture of the third cuneiform.

Recent Luetic Aortitis Shown on the Radiograph.
By Dr. Lick.

A young man who had been infected with syphilis seven months past was examined radiographically because of pain in chest, feeling of oppression, palpitation, anaemia and loss of weight. The plate failed to show tuberculosis of the lungs, but instead a peculiar enlargement of the aortic arch. It extended 2 cm. to the left and 2½ cm. to the right of the shadow of the spine. The shadow cast by the enlarged aorta was a rather faint or transparent one, differing markedly from the density of true aneurysmal enlargements or old arterio-sclerotic dilatations. This fact strengthened the theory that the enlargement was due to a recent luetic process in the aorta following the infection seven months back. The author calls attention to the importance of X-ray examination of syphilitics with chest symptoms. The prognosis is unknown.

Action of Roentgen Rays upon Cell Chemistry.
By Meyer and Bering.

Experiments were undertaken to determine the action of the X-rays upon

1. The normal cell ferments.
2. The chemical composition of the exposed tissues

The following conclusions are recorded:

A. The X-ray, in moderate dosage, has a slightly inhibitive action upon peroxydase (a ferment contained in horseradish). In massive doses, its activity is decreased 5 to 10 per cent.

B. Even in massive doses, the X-ray has only a slightly inhibitive influence upon the peptolytic ferment of yeast.

C. Intense irradiation has only a slightly retarding action upon pancreatin.

D. The X-ray has only a very little influence upon autolysis.

The Accessory Nasal Cavities and Their Diseases as Seen on the Radiograph.

By Brunslow.

This paper is based upon four years' experience at a military post. The great value and accuracy of the Roentgen method of examining the accessory sinuses in soldiers is emphasized.

In addition to outlining and detecting disease of the antrum, ethmoid and frontal sinuses, the author claims to be able to obtain the same information regarding the sphenoid sinuses. To delineate the sphenoids, he uses an angle differing from the accepted Caldwell angle where the central axis of the X-ray makes an angle of 25 to 30 degrees with the base line of the skull. To show the sphenoid sinuses the axis of the X-ray practically coincides with the base line of the skull. The shadow of the sphenoid is thus thrown higher than when using the Caldwell angle. It falls upon the shadow of the ethmoid cells but according to the author, the shadow of the sphenoid can be seen through that of the ethmoids if the radiograph is of proper quality. From such a postero-anterior view in conjunction with a lateral view, disease of the sphenoid sinuses can be detected and differentiated from lesions in the ethmoids. While regarding the postero-anterior view as the most important, the author nevertheless considers the lateral view of great aid in showing diseases of sphenoids, ethmoids,

and frontals (especially where both sides appear cloudy on the front view) and is also of importance in antral disease, since it may reveal an offending tooth.

The changes in the sinuses which as seen on the radiograph he classifies as follows:

1. Indistinctness of bony outline.
2. Haziness of entire cavity.
3. Complete clouding of entire cavity.
4. Mottled appearance of cavity, which author believes to be due to fibrous thickening of the mucosa and osteophyte formation, such as would accompany old healed processes.

A New X-Ray Apparatus.

By Fritz Schlenk.

The principle employed is the single interruption of the primary current and a single flash in the tube. The innovation lies in the method of producing the abrupt break of the current. A copper rod surrounded by a close fitting non-conducting sleeve dips into a dish of mercury overlaid with alcohol, the level of which rises above the upper end of the insulating sleeve. The interruption is produced by withdrawing the copper rod through the sleeve. A column of mercury follows the rod, but becomes attenuated until the intensity of the current through the clinging thread of mercury causes a sudden explosion, breaking the current and forcing the mercury column down.

Influence of the X-Rays upon the Sexual Organs of Man and Animals.

By Alex Faber.

The article consists of a complete summary of the literature upon this subject. A complete bibliography and resumé of Roentgen therapy in gynecology is included as well as histological changes in the ovaries of irradiated patients who have later come to operation.

Secondary Changes in Chronic Pulmonary Tuberculosis from the Roentgenologic Standpoint.

By H. Rieder.

The changes are considered under the following headings:

1. Dry Pleurisy.
2. Exudative Pleurisy.
3. Suction Exudates.
4. Interlobar Pleurisy.
5. Ensaculated Pleurisy.
6. Pleural Adhesions.
7. Pleural Thickenings.
8. Pneumothorax.
9. Displacements of Mediastinum.
10. Subphrenic Pyopneumothorax.

About 20 radiographs accompany the text illustrating each type.

Contribution to the Roentgen Therapy of Leukaemia.

By Guiseppe Lucibelli.

A well marked case of spleno-medullary leukaemia was treated by X-rays. White blood cells were reduced from 545,000 to 6,900, but the percentage of abnormal forms remained the same. Patient died at end of five months. A careful histologic report of all the organs is given which shows that incident to the vigorous X-ray treatment the organs lost almost all of their histologic characteristics of leukaemia. In spite of this remarkable change the patient lived but five months.

S. L.